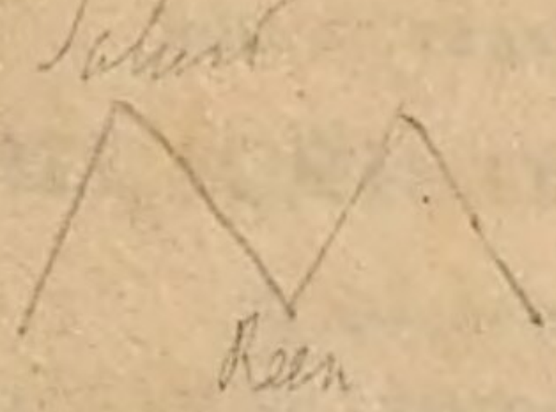


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INSTRUCTIONS

FOR

OFFICERS OF INFANTRY,

SHEWING

HOW TO TRACE AND CONSTRUCT

ALL SORTS OF FIELD WORKS;

As also the best Method to put

CHURCH-YARDS, CHURCHES, CASTLES, VILLAGES, TOWNS, &c. IN A STATE OF DEFENCE.

WITH FORTY-FIVE PLATES,

(INCLUDING SIX BY THE TRANSLATOR.)

BY GENERAL F. GAUDI.

TRANSLATED FROM THE FRENCH,

AND CONSIDERABLY AUGMENTED, WITH NOTES AND SUPPLEMENTARY CHAPTERS,

BY

C. MALORTI DE MARTEMONT,

Knight of the Royal and Military Order of St. Louis, and Captain in the French Royal Artillery,

Professor of Mathematics, Fortification, Military Sketching, &c. as well as every other Branch of the Military Art.

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1804.

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KÖNIGL BAYER. BIBLIOTHEK BAMBERG

TO

HIS ROYAL HIGHNESS

THE DUKE OF YORK,

COMMANDER IN CHIEF,

&c. &c. &c.

SIR,

THE following Treatise on FIELD FORTIFICATION, the Dedication of which your Royal Highness has most graciously condescended to accept, could not appear under more favourable auspices, than the protection of a Prince, who, independent of his illustrious birth, and his rank as Commander in Chief of one of the best armies in Europe, possesses knowledge and abilities, which eminently qualify him to judge of the subject on which it treats. Happy indeed shall

 I deem

I deem myself, if my work, agreeable to the motives by which I was induced to undertake it, shall procure me the heart-felt satisfaction of being serviceable to those officers who have so liberally encouraged it; of giving an useful testimony of my warm gratitude and zeal towards his Britannic Majesty, whom I had the honour to serve, and towards a land which I consider as my adopted country.

I am,

with the most profound respect,

SIR,

Your Royal Highness's

most obedient,

and most humble servant,

C. MALORTI DE MARTEMONT.

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PRE-

ERRATA.

Page 44, line 13, *note*, *read*, each piece of cannon, with its appurtenances, two hundred, &c.

Page 47, line 16, *note*, would be less exposed, &c. *read*, and being less exposed to be enfiladed.

Page 114, line 5, *for*, the first, *a*, &c. *read*, the palisades in the first row *a*, &c.

——— line 9, *for*, from the perpendicular, planted, *read*, from the perpendicular, being planted, &c.

Page 127, line 16, *for*, through which loop-holes are pierced, *read*, and through them loop-holes be pierced.

Page 210, line 8, *note*, *for* a perpendicular *e f*, (fig. 13, 14, 15), *read*, a perpendicular *e f*, (Vide plate 40, supp 1, fig. 13, 14, 15).

Note.—For the convenience of those of my readers who are not proficient in geometry, it was my intention to explain the manner of erecting a perpendicular on the centre of a line, which operation must necessarily be known for tracing works, either on the ground or on paper. This explanation having been omitted in the printing, shall be here introduced.

To erect on paper a perpendicular on the centre of the line *a b*, (plate 2, fig. 4), with any distance in your compasses greater than half the line *a b*, and one foot of the compasses being placed in *a*, describe with the other foot an arc above that line, and another below it. Next, place one foot of your compasses in *b*, and with the same distance, describe in like manner two arcs, which will cut the two former in two points *d* and *e*. Lastly, from those points draw *e d*, which will be perpendicular on the centre of the line *a b*, and will consequently divide it into two equal parts.

When you want to erect such perpendicular on the ground, you must first determine the centre *c* of the line *a b*, which can easily be performed by measuring that line. Next, fix

succes-

successively at the points *a*, *b*, the extremity of a cord, at the other extremity of which a stake, blunted at one end, is fastened, then stretching the cord, describe by means of that stake the above-mentioned arcs. If you are not provided with a cord of a sufficient length, after having determined the center *c* of the line *a b*, take on this line, and right and left of the center *c*, two points equidistant from this latter: proceed from those points as from *a* and *b*.

You also may erect a perpendicular on the ground, by constructing at the point where it ought to be erected, a right angle by means of the cord, and according to the method proposed by the author (page 40, section 2): the direction of that part of the cord which measures four feet will be that of the perpendicular.

PREFACE

OF THE TRANSLATOR.

GAUDI's work (of which Colonel Pleydel has already given a much admired translation, and which has been deservedly chosen for the foundation of the present Treatise on FIELD FORTIFICATION,) is universally considered as one of the best that ever was published upon the subject. The principles therein contained invariably coincide with those of the most skilful engineers, and are elucidated with such uncommon conciseness, that it is equally easy to comprehend and to retain them. The Author, who was well aware, as he himself has observed it to his readers, that all officers were not in the same degree proficient in mathematics, has been very attentive not to introduce

geometrical theory; every officer therefore, although he be unacquainted with permanent fortification, needs but the aid of those practical means that are pointed out by Gaudi, to be taught within a short period, with great facility, and without difficult problems to check his progress, how to trace and to construct such FIELD-WORKS as are in most general use, and also the method of fortifying the different posts stated in the title page.

Gaudi's work is moreover entitled to pre-eminence over most elementary books that treat of Field Fortification, and which are very imperfect, in so much that they merely indicate rules for tracing and constructing *field-works*, without making any application whatever of them, on a spot of ground delineated for the purpose, a representation of which will at least convey a general idea * of

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* I say *a general idea*, because as the ground varies continually, the form, nature and dimensions of the works must also vary. However, notwithstanding from that very reason,

the manner in which thoſe works are to be combined according to the nature of the ground.

We will allow that, with the aid of such books, an officer may learn how to trace and to construct either *a Redoubt*, *a Fleche*, or even *regular fronts*: but how incomplete will that knowledge be, if that same officer is ignorant how to adapt the works to the form of the ground, which (as I have observed above) is seldom regular, varies continually, and consequently requires, at every minute, works of different form, kinds and dimensions; if he knows not how to combine these works together, so as to profit by every advantage that the ground may offer, and to avoid whatever might prove prejudicial.

With a view of enabling officers to attain

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reason, it becomes impossible to prescribe rules applicable to every case, yet it may easily be perceived, that *a general idea* will prove of most essential service to all officers, especially to those who, besides the *coup d'œil*, are possessed of natural genius.

that knowledge, and at the same time a proper understanding of topographical maps, Gaudi has delineated in some of his numerous plates, parts of a district, and, in some others, whole districts.

His book, however, wanted commentaries and augmentations. The Author having composed it many years back, he had it not in his power to treat of those amendments, which the progress of knowledge has since suggested: moreover, some of the principles introduced in the work required to be enlarged; and Gaudi, by confining his *instructions*, as it were, to the method of tracing and constructing those works, which officers of infantry may have occasion to construct, left a wide field for improvement. In fact, many circumstances may occur when an officer, who is desirous of discharging his duty with some degree of eminence, will feel the necessity of possessing greater abilities, whatever corps he may serve in. A subaltern officer, it is true, may not always have occasion for such superior knowledge,

ledge, but all gentlemen belonging to the army look forward to the time of promotion, and entertain hopes of preferment, even of becoming general officers. Now, should they succeed so far, and be appointed to attack or to defend one of those important posts, that are generally fortified by engineers, how would they be able to effect it with credit to themselves, if their whole science did not extend beyond *certain rudiments* of *field fortification?* They would be under a necessity of having engineers constantly to attend, and to direct them, not only in the formation of plans, but even in the method of carrying those plans into execution. The least obstacle, the slightest unforeseen event would check them, on account of their not possessing sufficient knowledge to conquer those difficulties. If on the contrary, we suppose an officer to be properly versed in the art, he will know how to avail himself of every resource, and consequently will execute, in a distinguished manner, every operation that is entrusted to him.

It is with the intention of supplying those deficiencies in Gaudi's work, and, as it were, of finishing what he has begun, that the present new translation, with additional commentaries, has been attempted. No one article has been omitted, the translation is accurate, but several articles have been occasionally enlarged, either to render them of a more easy conception, or to extend the application thereof. This treatise is not confined within such narrow bounds as Gaudi's Elements; the *instructions* it contains are not limited to the mere method of tracing and constructing those works which any officer of infantry may be ordered to trace and to construct, but, from the reasons above mentioned, they comprehend directions for the construction of all *field-works* that may be used according to the modern system. Gaudi's plan, however, has never been deviated from, neither has geometrical theory found its way into any of the supplementary articles; the explanations are simple, clear and concise: the additions therefore will be as

intelligible

intelligible to every capacity, as the work in its original state.

In order to ensure the attainment of the proposed end of this treatise, all such definitions as have been thought requisite, to render it easily comprehensible to all, and particularly to those readers who are not proficient in permanent fortification, are given in a separate chapter. Such general precepts as relate to both *permanent* and *field fortification*, have also been introduced. Finally, the rules which are to be adhered to, in the attack and defence of *field-works*, have been very much extended; nay, I will make bold to affirm, that I have omitted nothing that might be conducive to the farther instruction of officers in every branch of *field fortification*.

The supplementary articles, which did not require farther explanation, are inserted in the form of notes; with regard to all others, it was my first intention, in which I persevered even when I published my Prospectus, to treat of them under the title of Observations, (as

also of the different works which Gaudi has omitted to mention) in a supplement, in continuation of the original work; but, as it has occurred to me since, that my first plan might create a kind of confusion, and be attended with some inconvenience to my readers, and my chief aim being to remove even the slightest difficulties, which might prevent my being perfectly intelligible, I have introduced all those supplementary articles in the body of the work, in that natural order which Gaudi himself would have assigned to each, had he mentioned them in his work; these articles and the plates relative thereto, will be known by the mark (supplement) annexed, so that the supplement, in continuation of the original work, will comprehend such articles only, as would admit being detached from the body of the work, without any inconvenience to the reader.

INTRO-

INTRODUCTION.

EVERY military man, every officer of infantry in particular, should be a perfect master of the art of fortification. I do not mean permanent fortification in all its branches; but the art of defence in general, and chiefly that of taking every advantage that can possibly offer, properly to fortify and secure those posts, the defence of which may be committed to his immediate care, in the course of service*.

---

* In order to elucidate those particulars more minutely than Gaudi has done, and thereby enable all officers not only to procure a more complete knowledge, but to make the application of them with greater facility, I have been obliged to introduce several notes, some of which are necessarily of considerable length. Perhaps it will be objected that, from all those minute details I seem to require from officers of infantry, for whom the Author has intended these instructions, the same precision, complete knowledge, and perfect execution which it is incumbent upon engineers to be possessed of, and that of course I deviate from the original plan. It may also perhaps be argued, that in field fortification, when you are often short of time and of materials, it is impossible the construction of the works should always be brought to perfection, and the proper preparation of the materials duly attended to. I shall answer to those objections, that if the time and means be the same, I cannot conceive the reason why an officer of infantry should not execute with the same

degree

Those officers should render themselves able, without having recourse to the assistance of an engineer, to trace out and construct redoubts, field-forts, têtes-de-pont, and all other works of the kind; to put into a proper state of defence, churches, church-yards, castles, villages, small and large towns, &c. so that the enemy should be obliged to bring forward a much superior force for the attack, and even then, after having sustained a considerable loss, be finally compelled to retreat, their attempt having been rendered abortive.

It is also necessary that an officer, who intends to fortify a post, should know how to take every advantage the ground will afford,

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degree of perfection as an engineer, the different operations which, according to the Author's own assertion, *may be committed to his immediate care*, in the course of service. Perfection ought always to be aimed at; besides it will be found, throughout the whole of the following pages, that I have made it my particular study chiefly to explain the process of those operations. In reply to the other objection, I shall say, that as sufficient time and materials are frequently wanted for field fortification, it is a strong reason why an officer should be possessed of more knowledge and talents, since he must have recourse to his own imagination to supply those deficiencies; and that this resource will more naturally and more instantaneously occur to the mind of an officer who is truly proficient, than to that of him whose knowledge is but superficial.

and

and be sensible that each particular line of a field work inevitably requires a direction truly adapted to the spot on which it is to be constructed, nay to the ground near it. At the same time he should be able to foresee, in some measure, on which side it is most likely the enemy intend to make their attack, so that he may throw such obstacles in their way as will prevent their approaching with success. He accordingly should understand well the manner of forming an abattis; of laying a dam across a river, in order to stop its course, and cause an inundation; likewise know how to make fougasses, or small mines, which, when properly constructed in front of field-works, are well calculated to render the access more difficult; he, in short, should make use of many other contrivances of the same nature, which, to a man of genius, will seldom fail to occur *.

Officers who love their profession, will study these things diligently in time of peace, in order to be able to practise them when called

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* The art of defence does not consist merely in erecting a parapet, digging a ditch, forming abattis, &c. &c. it requires besides a military *coup-d'œil*, and to know how to take every advantage the ground may offer.—TRANSLATOR.

out

out in the field; if not, they may frequently be exposed to find themselves in a situation equally critical and perplexing. Let us admit that the defence of a pos be entrusted to an officer, with orders to maintain it to the last: how very uncomfortably situated must he be, if totally ignorant how that post should be fortified? When at a loss what measures to take, he can make but a weak defence: the enemy therefore, will soon force him, and his conduct, very deservedly, incur universal censure. He will naturally be charged with having failed in his duty, without the mortifying acknowledgment of ignorance being considered as an excuse. An officer ought never to lose sight of his duty to his Sovereign, of his love of his country, of a sincere attachment to his profession; of his own personal safety, with that of those intrusted to his care; of honour, a thousand times more valuable than life; lastly, of the truth of that maxim, which so many repeated instances have verified, *that one* hundred *men properly posted, and entrenched according to rule, can effect more than one* thousand, *who have taken a wrong position.* —These considerations will prove how absolutely indispensable it is for officers to have a

complete

complete knowledge of what we have recommended above, the acquirement of which requiring but a very short time and little application, they who neglect any opportunity of improving themselves, are the less pardonable.

It is also incumbent upon an officer to make himself familiar with the study of maps, and with those plans where the particulars are more minutely elucidated: not that we mean he should be a complete draughtsman, or able to take the survey of a country, and represent it upon paper; but merely that he should have a sufficient understanding of such draughts, to be a competent judge of their accuracy or defects.* A knowledge of this kind will

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* The most correct plans can be of but very little service, especially to those who make preliminary studies, unless they are accustomed to compare them with the ground which is represented, and able to investigate how far the topographical marks that are therein made use of resemble nature. The manner of reconnoitering a ground, and of making a military sketch of the same, is of so great importance, that I wonder so very few authors have written on that subject. I intend publishing, within a short period, a *Treatise on Military Reconnoitering* in general, in which I shall elucidate the most plain and easy method of reconnoitering grounds of every nature, and of making a military sketch of them.—TRANSLATOR.

be

be subservient to convey some idea of the march of an army, also of all its divers movements, positions and encampments. Though in a subaltern rank, he can but derive great entertainment from the information, which he cannot do without, if he holds a higher station. The man who is desirous of gaining credit in his profession, and truly sensible of his own interest, will of course use unremitting assiduity in his younger years, in order that, on proper occasions, he may give proofs of his genius: that such opportunities may occur, ought to be the summit of his ambition.

All military expeditions entirely depend upon a perfect knowledge of the country. An officer unacquainted with this essential point, may indeed chance to take proper measures, but they are merely accidental; whereas the man of study who by application has acquired a *coup d'œil*,* will ever have them at command. An officer whose only resource lies in his courage, must be in the greatest uneasiness concerning the success of an enterprise, or the

---

* The *coup-d'œil*, I confess, is a gift of nature, but the habit of exercising it is highly conducive to improve that faculty, and to rectify it.—TRANSLATOR.

means

means of baffling the designs of the enemy; he must entirely depend upon the advice of those under his command: but a man of true ability, should even his case be of a most desperate nature, finds sufficient resource in his own mind, and by adopting at once the most prudent and skilful measures, soon changes the face of affairs, and reaps the fruit of his youthful labours. Those wise measures completely defeat the enemy's designs, procure advantage to his king and country, gain reputation, with the esteem and friendship of his superiors; secure the confidence and attachment of every individual under his command, and also the approbation of every one of the profession.—Rewards which overbalance all others in the mind of a man of honour.

The following work is intended to evince how very easily all this knowledge may be acquired. It will shew that an officer needs not employ any of his time in the dry and tedious study of mathematics, to become a field-engineer. Certain it is that many, after having thrown away great part of their lives over the scale and compass, have yet been unable to fortify posts in a proper manner, owing to their being ignorant how to take every advantage of

the

the ground, or how to judge of its strength and deficiencies; these are branches of knowledge most essential in an officer, and without which he must renounce ever acting up to the spirit of his profession.*

The art of putting all kinds of posts in a proper state of defence, requires neither problems nor tiresome calculations; a little practice and mechanical knowledge will suffice to obtain it. We, therefore, throughout the

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* The author, in my opinion, appears rather too averse to geometrical knowledge, and to the use of instruments; for if, as he advances, many officers after having wasted a deal of time in using the scale and compasses, have finally been incapable of fortifying posts as was required, it proceeds only from those same officers, after having studied field fortification in elementary books of the nature of those which I have mentioned in my preface, and of the insufficiency of which I have made my readers sensible, have not subsequently either improved their instruction by the reading of other works, better calculated for the purpose, exercised their *coup-d'œil*, studied the ground, or added any practice whatever, to the imperfect theory they had acquired; therefore the instruction they had received would be of no avail to them. It would be very unjust, however, to conclude from thence, that mathematical knowledge is of no service for *field-fortification*; all learned men will allow that mathematics are the basis of all the other sciences, and that a knowledge of them will render more easy to military characters, the study of *field-fortification*.—TRANSLATOR.

whole

whole work, have adhered strictly to this principle: to avoid being tedious, we have confined ourselves, as much as possible, to an exact distinction in the subjects we have written upon, and we hope they will be acceptable to the reader. Although I am conscious of having omitted nothing material, yet the whole work comprehends but a few sheets. I could not, however, dispense introducing a certain number of plates, that every part might be thoroughly intelligible. The whole amount to thirty-nine, and I candidly avow that I would continue very little concerned, were I blamed for having so many; as no one will dispute that a work intended for instruction can be too fully explained. The plates may likewise be of essential service to such officers as wish to obtain a thorough knowledge in ground; the most common incidents, in point of situation, are touched upon: some of them comprehend parts of districts, and others whole districts.

DEFINITIONS.

(SUPPLEMENT)

OF FORTIFICATION IN GENERAL.

FORTIFICATION is the art of putting any place or post whatever in a favourable state of defence; it implies also the method of attacking and defending the same.

It is evident from the above definition, that *fortification* may be divided into offensive and defensive.

Defensive fortification is divided into *permanent* and *temporary*.

Permanent fortification is particularly applied to the erecting, attacking, and defending of such places as are properly denominated *fortresses*, and which are constructed in time of peace, to the purpose of protecting a whole country against any future attack or irruption of the enemy.

Temporary fortification, which is called *field-fortification*, has a similar object to that of permanent fortification, namely, to procure the means of enabling a small number of

men

men to defend themselves with less danger against a greater number, who attack them; but it differs in this one point, namely, that *field-works* are only intended to exist for a short limited period, that they are frequently constructed in the greatest hurry, when many requisites are wanting, and sometimes in the presence of the enemy.

VARIOUS KINDS OF FIELD-WORKS.

A fort, generally so called, is a place surrounded by a parapet.* Forts, however, receive different appellations, according to their figure, and to the number of their sides or faces.

A fort, whose figure is a circle, is called a *round* or *circular* fort.

A fort is said to be a *triangular*, *square*, *pentagonal* or *hexagonal* fort, &c. according as it has three, four, five, or six, &c. sides, or faces.

When the circumference of a fort is composed of lines forming alternate salient and re-entering angles, Pl. 15. and Pl. 16. fig. 1, 2; it is called a star fort, and likewise receives the appellation of a square star fort, of a pentagonal

* Parapet or breast-work, means the same thing.

or hexagonal star fort, &c. according as its salient angles are four, five, six, &c. in number.

Such a fort, as represented Pl. 40, (supp. 1, fig. 1,) is called a *fort with bastions*.*

All field-works that have no flank defence of their own are called redoubts, Pl. 4.

Half-redoubt, fleche or *arrow*, is a small work with only two faces, which form a salient angle, Pl. 2, fig. 1, 2.

Redoubts en cremailliere are so denominated from their figure, which resembles a pot-hanger, or the tooth of a saw, Pl. 12, and 13.

Têtes-de-pont are works that are made of various forms, and intended both to cover bridges of communication, and to contain the troops which are destined to protect the manœuvres of a body, either when forcing their passage over a river, or when repassing it on their retreat, Pl. 18, 19, 20, 21, 22, 23, 24.

INTRENCHMENTS.

All works erected for the purpose of augmenting the means of defence of any post

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* As I only give general definitions in this chapter, the *particular* names of the different parts of a bastion will be found in the Supp. Art. *forts with bastions*.

whatever

whatever, are called *intrenchments*; these intrenchments are susceptible of assuming various forms or figures.

Intrenchments with redans, Plate 41. (supp. 2. fig. 1, 2.) are composed of fleches, erected at about 120 toises distance from one another, and in general * joined together by means of a line, either straight or broken in its center. These fleches A, B, C, fig. 1. are named *redans*, and the lines *b c*, *d e*, are called *curtains*.

When instead of redans, there are bastions erected, the intrenchment is then called *intrenchment with bastions*, Plate 41. (supp. 2d. fig. 4,) Plate 42. (supp. 3d. fig. 1, 2, 3.)

Such an intrenchment as that represented Pl. 41, (supp. 2, fig. 3,) is called *an intrenchment with tenailles*.

If in front of an intrenched post, and at a distance of 60 toises, fleches should be thrown up, having a covered communication with

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* I say in general, for intrenchments may occasionally be composed of single redans, which are not joined together by curtains. In the fig. 2. the curtain *d e* is broken in its center *c*; by which is meant, that instead of being in a straight line, it forms an angle.

the main work, and which are defended from the said main work, the intrenchment is then called *an intrenchment with lunettes*, Plate 43. (supp. 4, fig. 2, 3.)

Such an intrenchment as that represented, Plate 43. (supp. 4, fig. 1,) is called *an indented intrenchment*, or *intrenchment en cremaillière*.

According to the ground, or to some other circumstance, which shall be explained hereafter, intrenchments may be either *connected*, that is, without any unfortified intervals, or formed by single or unconnected works, which defend each other.

A work totally surrounded by a parapet is called *an enclosed work*.

OBSTACLES.

A parapet is an elevation of earth thrown up around a fortified place, and which, owing to its height and thickness, serves to protect the men who are to defend it against every attack from the enemy, and especially against the fire of his musketry and artillery.

Now the parapet being made of loose earth, it could not possibly stand long, if its outer and inner sides were carried up perpendicular to the horizon; therefore it is proper they should

should make an acute angle with the horizontal base of the work. The slope of the sides is called *the interior and exterior slope* or *talus* of the parapet.

The upper surface of the parapet is called the *summit* or *crown*; it must be made sloping towards the country, otherwise the enemy could not be hit from behind the parapet, when advanced within a moderate distance from the work. The slope of the upper surface is called the *slope or talus of the summit of the parapet*, or simply, *the slope or talus of the parapet*.

As the height of the parapet exceeds that of the men who are to defend the work, an elevation of earth is made immediately behind, and at the foot of it, which is called *banquette*; this elevation, which the soldiers mount when they are to fire, enables them to fire over the parapet.

To render the ascent of the banquette more easy, you must give a slope to its inner side, which is called the *slope* or *talus* of the banquette.

A small space must be left between the foot of the parapet and the ditch, which is called the *berm*, and intended to prevent the giving way of the *scarp*, which would have too great

a pressure to sustain from the parapet, if the exterior slope of this latter, and the scarp formed but one continued surface.

It is customary to make a ditch on the outside of the parapet, in order to procure the earth that is required for the formation of the parapet, as also to oppose an additional obstacle to the enemy.

Both sides of the ditch must have a slope or talus: that of the inner side is called *the scarp*, and that of the outer side, the *counterscarp*.

The *covert way* is a space left between the counterscarp and the glacis.

The glacis is a kind of parapet raised up beyond the ditch, the summit of which ought to be continued outwards in a gentle slope, and gradually decreasing till it meets the surface of the ground.

We call an *advanced ditch* a second ditch, formed in front of the former beyond the glacis.

A covert way practised beyond an advanced ditch is called an *advanced covert way*.*

* The profiles in plate 44, supp. 5th, will fully elucidate all these definitions, as they are descriptive of the different parts to which they are relative.

The parapet in fig. 2, being seven feet and a half high,

and

ADDITIONAL OBSTACLES.

Besides the parapet, the ditch, &c. other obstacles may be presented to the enemy to check his progress, or impede him in his attempt to become master of a work, these are as follow:

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and that in fig. 3, nine feet, both require two banquettes, as the plate will shew.

In fig. 2, the line A B represents the horizontal line.

a—Slope or talus of the first banquette.

b—First banquette.

c—Talus of the second banquette.

d—Second banquette.

e—Interior talus of the parapet.

f g—Interior height of the parapet.

f h—Talus of the summit of the parapet.

h i—Exterior height of the parapet.

k—Exterior talus of the parapet.

l—Berm.

m—Talus of the scarp.

n n—Breadth of the ditch at bottom.

n o—Depth of the ditch.

p—Talus of the counterscarp.

q—Covert way.

r—Interior talus of the glacis.

s t—Interior height of the glacis.

s u—Talus of the glacis.

x—Advanced ditch pointed at bottom.

y---Advanced covert way.

Palisades,

Palisades, a name given to one or several lines of square stakes, pointed at the top, and driven two or three feet deep in the ground; these are joined together near the top with laths, which are fastened to them with rivetted nails. Pl. 29, fig. 2, 3.

Fraises are a kind of palisades placed nearly in an horizontal direction (by which is meant, that the pointed ends are rather inclined towards the bottom of the ditch) in the revêtement of the parapet. Pl. 29, fig. 1.

Chevaux de frise are square beams through which stakes four inches thick are driven in an oblique direction, so as to cross each other, and to stretch out as much on one side as on the other, in such a manner that two rows of those stakes touch the ground, and the other two are upwards. Pl. 29, fig. 4.

Trous-de-loup are holes pointed at bottom, in the middle of which a stake pointed at the top is two feet lower than the top of the hole: trous-de-loup are placed in front of the parapet, and about sixteen or twenty feet from the counterscarp. Plate 30, fig. 1.

Crows-feet, or *chausse-trappes* are pieces of iron with

with four points, each a few inches, and so formed that in what manner soever they may be thrown, one of the points always remains upwards.

An abattis is formed by means of trees cut down, placed close by and over one another, so that their heads are presented towards the enemy and their trunks towards the work.

Fougasses are small mines whose chamber is sunk but a few feet deep. Plate 39.

VARIOUS DEFINITIONS.

Pieces of cannon placed adjacent to one another behind a parapet form *a battery*.

There are two different sorts of batteries, namely, batteries with *embrasures*, and batteries *en barbette*.

Embrasures are openings so practised in the parapet that the guns may fire through them. Plate 40, (supp. 1. fig. 7.)

Where cannons are to fire over a parapet without embrasures, we call it *firing en barbette*.

Enfilade. A work is said to be enfiladed, when a gun may fire into it, so that the shot may run all along the inside of the parapet.

By

By *cross fire* is meant the fire of two or more adjoining sides crossing each other.

A breach is an opening made in a wall or parapet with cannon or mines, sufficiently wide for a body of troops to enter into the work and drive the enemy from it.

Command. When a hill or rising ground overtops any work of a fortification, and is within cannon shot, that hill or rising ground is said to command that work.

Epaulement is a kind of parapet to cover the troops.

A Revêtement is a lining generally made in the field, and composed of fascines or sods, sometimes of hurdles of willow twigs woven together in the manner of basket-work, the object of which is to support the interior, and sometimes the exterior side of the parapet.*

A traverse is a parapet made within field-works to cover their entrance, or when there are any hills or rising ground from which the inside of the works may be discovered.

A fascine (common) is a kind of faggot made of branches tied in two or more places, of about six or eight inches diameter.

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* The *revêtement* is also called *lining*.

A saucisson

A saucisson is a fascine which is longer than the common one, and which has in general one foot diameter. Saucissons are used for the revêtement of batteries, parapets, and for repairing breaches, &c. Pl. 40, (supp. 1, fig. 2.)

A gabion is a kind of cylindric basket open at both ends, of about three feet wide, and from three to six feet high, which is filled with earth. Pl. 40, (supp. 1, fig. 4 and 6.)

Loop-holes are square or oblong holes made in a wall to fire through with muskets. Pl. 31. *a.*

Communication is a passage from one work to another, and generally covered by a parapet or palisades on each side.

A Place of arms. This word has different acceptions in fortification; however, it always means a proper place for collecting the men and materials, as also the engines of every description destined for the attack or defence of a post.

A block house is a building of timber erected in the middle of a work to shelter the garrison, and especially the guard, from bad weather: it ought to be roofed with beams, over which earth and sods are heaped a few feet thick.

Plunging, or fichant fire. We call *plunging, or fichant fire*, that which proceeds from a spot more

more elevated than that upon which the fire is directed.*

Grazing, or rasant fire is that which is shot from a spot on a level, or nearly so, with the object against which it is directed.

A work, or an intrenchment, is said to be battered *in front*, when the shot or ball arrives in perpendicular direction, or nearly so, with its front line.

It is said to be battered in *echarpe* when the direction of the ball or shot forms a sensible acute angle with the front line of the work.

When the direction runs along the prolongment of the front line of the work, it is said the work is battered *in flank*.

A work is battered *in rear* when the shot or ball hits its rear in a direction perpendicular, or nearly so, with its front line.

Lastly, it is battered *in revers* when the line of direction of the shot or ball forms (in the rear) a sensible acute angle with the front line of the work.

Profile is the delineation of the vertical section of a work, indicating the dimensions of the several parts which compose it.

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* The words *fichant* and *rasant* fire have also a different meaning. Vid. supp. art. *forts with baſtions*.

LINES.

Parallel lines are those which are every where equidistant, and would never meet, to whatever length they might be carried either way on the same plan.

A line is said to be *perpendicular* to another line, when it falls upon it so as to make the angles on either side equal; and then both are right angles.

The capital of a work is an imaginary line, which divides into two equal parts the flanked angle of that work.

The gorge is also an imaginary line, whose length is determined by the distance between the two faces of any work.*

Those parts of a work which project the most towards the country, are called *faces*. Faces by their meeting form the flanked angle.

The flank is a part of a work which defends another work along the outside of its parapet.

The line of defence is the distance between the angular point of the flanked angle and the flank. Lines of defence may be either *rasant* or *fichant*.†

* The bastion and half moon, with flanks, are excepted.

† Vid. supp. art. *forts* with *bastions*.

Lines

Lines of fire are those parts of a parapet which point their fire towards any particular place. We also call lines of fire those lines which in the plans show the direction of the fire.

The works made by an army from one town or strong post to another, and behind which it is encamped to protect a country, are likewise called *lines*.

Lines of construction are temporary lines drawn with a pencil, which are used merely for the tracing of a plan on paper, and are erased when the plan is completed.

ANGLES.

The opening of two lines (*ab*, *ac*, Pl. 1. fig. 3 and 4,), which meet each other in a point *a*, is called an *angle*,* and the point *a*, where they meet, is called the angular point.

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* An angle is generally expressed by three letters, the middle one always shews the angular point, and the other two the legs or sides that include it. However, unless several angles have their angular point at the same point, it will be sufficient, in order to indicate an angle, merely to name the letter which marks its angular point.

All angles are measured by the arc *d d*, Pl. 1. fig. 5, described from the angular point *a* as center to any radius,* and terminated by the lines *a b*, *a c*, that form the angle, and which are called *sides* or *legs*.

A right angle is that which contains 90 degrees.

An acute angle contains less than 90 degrees.

An obtuse angle contains more than 90 degrees.

A salient angle is that whose angular point turns from the centre of the work. The angles *a*, *b*, *c*, *d*, Pl. 1. fig. 6, are salient angles.

A re-entering angle is that whose angular point turns towards the centre of the work. Vid. the angles *e*, *f*, *g*, Pl. 1. fig. 6.

The flanking angle is that which is formed by the flank and the line of defence.

A flanked angle is a salient angle, whose legs are defended from the fire of the flanks.

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* An arc is a certain portion or number of degrees, of the circumference of a circle, which circumference is known to be 360 degrees for any circle whatever. The radius is the distance from the centre to the circumference.

Flanking is the same thing in fortification as defending.

MAXIMS,

OR,

GENERAL RULES OF FORTIFICATION.*

(SUPPLEMENT)

1st. THE parapet of a work ought not to be commanded by any height or point whatever of the country within cannon shot. † Care must also be taken that there be no cover in the vicinity of the work, under which the enemy might approach unperceived.

2d. If there should be several works within reach of one another, they must be disposed so as to protect each other mutually by their fire, without a possibility of receiving any injury from it.

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* Some of these maxims have been introduced by Gaudi in his work, but in my opinion they are not sufficiently elucidated.

† It will sometimes happen, owing to the above inconvenience, that the height of the parapet must be increased. I shall explain hereafter in what manner this additional height is to be determined upon.

3d. Such works as are intended to defend others, should not be at a greater distance than the arms, with which the latter are to be defended, can reach. *

4th. The musketry is not to be depended upon, except for the defence of those parts that are battered in right angles. †

5th. You must never have recourse to the second flank but when you cannot do otherwise. ‡

6th. The flanking angle, that is, the angle which the flank forms with the line of defence, must always be either a right angle, or more open than a right one, but it should not be above 100 degrees, or as little more as possible. ||

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* The reach of musket shot is allowed to be from 120 to 150 toises, but it is only at the former distance at most, that the effect of the musketry can be relied upon. However, if the lines of defence were drawn from two flanks, separated by branches forming a salient angle, or if they were not intended to cross each other, although prolonged, as in indented intrenchments, for instance, which I shall explain hereafter, they then must not be more than 60 or 80 toises.

† Because experience has evinced, that the soldier most generally fires directly forward, without taking his aim.

‡ Vid. supp. art. *forts with bastions.*

|| If the flanking angle was an acute one, you would be

7th. The flanking parts must always be sufficiently salient, in order that from within side of the parapet, you may batter the whole breadth of the ditch of the part that is flanked. *

8th. An advanced ditch is never to be made that cannot be filled with water, unless it be clear and enfiladed in its whole extent, and in an angle able to protect it from the work which it covers, or which it encompasses. †

9th. All the parts of an intrenchment, if possible, should be equally strong. ‡

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in danger of your own fire; if, on the contrary, it was too obtuse, the fire would no longer defend the ditch of the flanked part, it would be too far from the work, would cross less over the salient parts, or perhaps there would be no cross-fire at all.

* When the enemy is close to the work, especially if he marches in column, the direct fire seldom stops them; when in the ditch, they are covered from it, therefore there is no other fire then, except that of the flanks, which can do execution.

† If the advanced ditch in dry ground is not clear, and enfiladed in its whole extent, instead of offering an additional obstacle to the enemy, it would present a shelter to them, where they might collect in force and refresh themselves.

‡ For if some were weaker than others, the enemy would

10th. The most salient parts, which by their nature are the weakest and the most exposed, should, as much as possible, be the best defended, and at least by the fire of two flanks, besides the front fire. *

11th. The interior space of all kinds of works should always be sufficiently extensive to contain the number of men necessary for their defence, and that they may be at ease; this is to be most carefully attended to when the garrison is to dwell in the work †.

12th. The extent of all manner of works, indiscriminately, must always be proportioned to the number of men, who are to defend them ‡.

13th. Particular care must always be taken to secure the flanks; in case the nature of the ground would not contribute to the attain-

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would naturally direct their attack against those weak parts, which would render the strength of the rest useless.

* This maxim is dictated by nature.

† This important maxim requires a detailed elucidation, which I shall introduce when I treat of the manner of determining the extent of a redoubt.

‡ If the works were too extensive, considering the number of men who are to defend them, the parapets would not be sufficiently manned, the reserves would be too weak, and consequently a good defence could not be made.

ment of this object, art must be recurred to. *

14th. Previous to your beginning a work, you must ascertain whether you shall have time, materials, and hands sufficient to finish it †.

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* Every intrenchment whose flanks are not well secured, can be turned; and therefore is rather injurious than useful.

† Were it not for these precautions, one should often be exposed to abandon a work that had been begun with great expence and labour, for want of time or sufficient means to complete it.

AN

ESSAY

ON

FIELD FORTIFICATION.

CHAPTER I.

Of Works and the Method of tracing them.

SECTION I.

THERE are field works of several kinds, namely, Fleches, round Redoubts, Redoubts with several sides, Star-forts, Tetes-de-pont, Intrenchments in front of a Camp, &c.

An Officer may trace out any of these works without doing it mathematically, which would require long calculations and proper instruments, by using a much more simple and easy method that entirely depends upon practice. Let him provide first a cord of about fifty fathoms, divided at one end into twenty parts of one foot each, and at the other in toises of six feet; next a certain quantity of pickets to mark the angles; and he will be

supplied with every article requisite for tracing field works. Were he under a necessity of constructing them in the night, he may use in preference a rope of straw, as being more easily distinguished.

SECT. II.

In works that are flanked, or when one side is defended by the fire of another, the best defence is that formed by right-angles; it is therefore indispensable to know how to lay them down with exactness. Twelve feet of the aforesaid cord are sufficient for this operation. Suppose a line A B, (Plate 1. fig. 1) at both extremities of which it is required to lay down a right angle to the front. At the extremity A set off three feet of the cord *c d*, and four feet to the front *d e*: now if you join *e c* with the remaining five feet of your cord (the end of which is fixed at *c*), you will have the right-angle you wanted. Right-angles to the opposite side, more properly called the rear of the line A B, may be laid down in the same simple manner. (Plate 1. fig. 2.) This method, however, would even be superfluous unless the angles must be traced exactly true, for otherwise the eye is sufficient, without using

using the cord, which a little practice will soon render easy.

SECT. III.

In all kind of works that come under the denomination of field-works, it is very immaterial whether the angles be exactly right, that is to say of ninety degrees, or more or less open; since the defence of such works will always be good, provided the angles are neither too acute, as in Plate 1. fig. 3, nor too obtuse, as in fig. 4.

SECT. IV.

It is a general rule in Fortification never to make a salient-angle less than sixty degrees, as otherwise it would be too acute. The eye alone may prevent the error; but if an officer cannot trust to his *coup-d'œil*, he may lay it down according to the following method.

At the extremity of the line where he is to form a salient-angle, let him trace a right-angle *b a e*; Pl. 1. fig. 5; at the point *a* let him fix a small picket, with a cord of five or six feet tied to it, and then with another picket at the other end of the cord describe the arc *d d*, of ninety degrees, the measure of a right-angle. Let him next divide the arc into three

equal

equal parts, by help of the rope, marking each with a small picket *d*: by this means he is sure not to make the angle less than sixty degrees, each division of the arc containing thirty, and of course two of them sixty degrees.

It is also a general rule never to make a re-entering-angle less than ninety degrees, otherwise the sides, instead of protecting each other, would do mischief by their fire: at the same time no re-entering-angle ought to be more than one hundred and twenty degrees, in order that the fire of the two lines may cross sufficiently. (Pl. 1, fig. 6.) The salient-angles are marked *a*, *b*, *c*, *d*; and the re-entering-angles *e*, *f*, *g*.

SECT. V.

There is another general rule to be observed in the defence of all field-works, namely, never to draw up the troops more than two deep; the reason for so doing is obvious; for if in three ranks, the third cannot fire without incommoding the first, who cannot kneel, as the parapet stands in their front. It is necessary therefore, that, previous to the dimensions of the work being determined, the strength of the detach-

ment

ment appointed for its defence should be known: for then no other calculation is required but to allow an ordinary pace, or two feet to each file, two deep. It would be a very good method for an officer, in order to be more expeditious in the raising of these kind of works, to accustom himself to such paces, which would save him the trouble of measuring the lines with the cord. If he is to have any cannon, he must allow six paces to a field-piece, and eight to a twelve-pounder: so that if he has forty men, or twenty file to defend a fleche, each face of the same must be ten paces, but if there are two field-pieces, each face is then to be sixteen paces. A square redoubt to contain two hundred men, or one hundred file, is twenty-five paces each face; and when there is cannon to be put into it, the same number of paces must be allowed to each piece, as we have just mentioned above.

An officer must always be careful to proportion exactly the size of a work to the number of men that are to defend it. If the work be too large, it cannot be manned properly, and the enemy will render themselves masters of it with very little pains or loss. The consequence is not equally bad if the work is too

small,

small, because then such as have no room to act may form a reserve, ready, if wanted, to reinforce the part attacked. The interior circumference of a square redoubt* must be at least eighty paces;† for if less, the garrison would only incommode one another, and suffer considerably if the assailants should use grenades.

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* The author having frequently made indiscriminate use of the expression *interior circumference*, or *parapet line*, to point out the interior compass of the parapet of a work: I beg leave to observe, that both in the supplementary articles, and in the notes, the same signification will be attached to these expressions; and that when I speak of the exterior compass of a work, the expression *exterior parapet line* will be used.—TRANSLATOR.

† And even one hundred paces, *if the garrison are to dwell in it*, for then it is to be calculated that each man will occupy a surface of at least eighteen square feet in the interior space of the redoubt, or of any other work, and each piece of cannon two hundred and sixteen square feet. According to this calculation, a square redoubt, the parapet line, or, to use Gaudi's expression, the interior circumference of which should be only eighty paces, could not, on account of the banquette, contain with ease the garrison it is intended for, which, agreeable to his method, should consist of one hundred and sixty men, allowing one pace for each file. I therefore shall repeat it, the interior circumference

SECT. VI.

If a work is of such a size as to require two or more battalions to defend it, a reserve must

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cumference of the smallest redoubt that can be constructed, must be at least one hundred paces, if the garrison are to dwell in it: nay, if any cannon are to be placed in it, which is most likely, fourteen or fifteen feet more must be added for each piece. Gaudi's method of determining the dimension of the interior circumference of a redoubt, is applicable only to such as have this extent, or that are occupied by the garrison only at the time of the attack.

With regard to others of a smaller extent, Clairac has given the following rule to find out their proper interior circumference, in proportion to the number of men that are to dwell in it.

"Find out a number, which being multiplied by itself is nearest the number of the garrison: multiply that number by four, and the produce will give you the extent of the interior circumference in toises.

"If, on the contrary, you wish to know how many men a redoubt of that kind may contain, multiply by itself the fourth part of the interior circumference of that redoubt, and the produce will be the number of men that can dwell in it."

I am of opinion, that if those two rules were strictly adhered to, the interior space of the redoubt would be found too extensive, especially if the interior circumference of the redoubt should be the nearer to one hundred paces; however, they may be of some use in the practice. In

these

always be appointed, and that to consist of the sixth part of the garrison. If we suppose twelve hundred men should be destined for the defence of a work, it must be constructed to contain only a thousand:* as the reserve, or two hundred remaining, will be placed in the centre, ready to act as circumstances may require.

SECT. VII.

I would recommend the following method to construct a fleche to contain sixty men, or thirty file, with two pieces of cannon. Let the officer who commands the detachment, upon reaching the spot where he is to remain, divide his men into two platoons, drawn up in form of a fleche (Plate 2. fig. 1. *a.*), consti-

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these small redoubts which require an interior circumference rather considerable in proportion to the number of men intended to dwell in and defend them, the parapet must unavoidably be thinly manned, it is adviseable therefore not to erect one.—TRANSLATOR.

* Redoubts so spacious are never to be constructed unless they be flanked by some other work, because redoubts not having flanks of their own, it is more advantageous, when it is intended to give them so considerable an extent, to substitute small forts.—TRANSLATOR.

tuting

tuting a right angle.* He then must stretch his cord along their front, to trace out the parapet line of the work, and add six paces to each face for the field pieces. This line marks the inside of the parapet *b*, which is not required to be more than six feet thick, in small fleches, intended to cover the quarter-guards of a camp. Next, he must trace a line pa-

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* It is not indispensably necessary that the angle of a fleche should be an exact right angle, yet it must not widely differ from one; that is to say, that it must neither be too acute, nor too obtuse. Great care must be taken especially not to make it too acute, for in that case it would not only be extremely weak, but the interior space of the fleche towards that angle would be a great deal too narrow.

Sometimes, in order to strengthen a fleche, two flanks are added to it, which in general form a right angle with its faces: but I think they would be placed to greater advantage under the angle of 100, or even 110 degrees. I must allow that the direction of the lines of fire would not then run so parallel with the faces, which inconveniency, however, would be overbalanced by the advantage resulting from the flanks advancing less on the side of the enemy, would be less exposed to being enfiladed; those flanks *g*, *e*, Plate 24, are generally covered by two parapets, *a*, *b*, which run in a parallel direction with the faces. If it were apprehended that the enemy would surprise the fleche through the gorge, it might be closed by the same means that are used to close other works.—TRANSLATOR.

rallel

rallel to the first, to determine the thickness of the parapet *b c*. He then proceeds by means of another parallel line to mark out the berm *d*, which is only a certain portion of the level ground left to sustain the weight of the parapet, which otherwise would be liable to tumble down. The breadth of the berm need not be above two feet. The ditch *e* which is afterwards to be traced, must be six feet wide, and the earth of it forms the breast-work. Then again a line is to be drawn, inside of the fleche, for the banquette *f*, four feet broad, and on which stand the men when they defend the work. The breadth of the banquette is made double, that is, eight or even ten feet, where the cannon are to be placed. The fleche now being completed, the men and guns are disposed as follows:

(Plate 2. fig. 2.) *a b*. fifteen file lining the right face.
e. a piece of cannon on ditto.
c d. fifteen file lining the left face.
f. a piece of cannon on ditto.

SECT. VIII.

Another method may be practised to trace a fleche for sixty men, or thirty file, and two pieces

pieces of cannon. The detachment, when arrived upon their ground, may be drawn up two deep in a straight line *a b*. (Plate 2. fig. 3.) Let them be divided into two platoons, and a non-commissioned officer placed in the center *c*, who, after marching directly forward as many paces as there are files in one platoon, fixes his halbert, or a picket, at the place where he halts, *d*, which gives the angle of the fleche. Then from *d*, let a straight line be traced to the right flank of the detachment *b*, and another to the left flank *a*, which gives the line of the parapet. The other lines are to be traced as directed in the VIIIth section.

SECT. IX.

If a square redoubt, to contain two hundred men, with two pieces of cannon, be wanted, it must be traced in the following manner:

	Paces.	
For two hundred men, or one hundred file, two deep,	100	Interior circumference of the breast-work.
Two pieces of cannon, six paces each,	12	
Total	112	

Divide the hundred and twelve paces by four, which is the number of the faces, and you will find twenty-eight paces for the length of

each face. (Plate 3.) Then trace out a line *a b*, of the above number of paces, and lay down a right angle, *d* and *c*, at each extremity; now, by prolonging the two lines that form the two right angles to *e* and *f*, twenty-eight paces, you will have three sides of the redoubt; so that by joining *e* and *f*, the square redoubt is completed.

It is a general rule always to make the entrance of a redoubt in the face least exposed to an attack or enfilade. To give room for the cannon to pass, this entrance must be five paces wide; but if there are no cannon, three or four paces are sufficient. It is also to be covered inside of the work by a traverse *g*, reaching three or four paces beyond the entrance on each side, to prevent the enemy discovering any part of the garrison in the rear. Care must be taken that the ditch of the traverse be at such distance from the entrance as not to obstruct the passage, and especially when there are cannon to be taken into the work.*

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* The distance from the ditch of the traverse, to the entrance in the redoubt, must be at least equal to the width of the entrance; the earth of which it is made is generally taken from the principal ditch of the redoubt, or from a small

The entrance may also be covered on the outside by a fleche *h*, which is generally practised when a redoubt is very large: in that case attention must be paid to have the ditch of the fleche defended by the fire of the face.

SECT. X.

The parapet of a redoubt should be thicker, and the ditch both wider and deeper than those of the small fleches constructed in front of a camp to cover the quarter guards, &c. otherwise the enemy's cannon would soon destroy them, as a ball from three to six pounds weight would enter three, even four feet into the earth, and a twelve-pounder nearly eight

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small ditch, which is made exactly in front of the traverse; and as there is no brisk attack to be feared on that traverse its parapet does not require being made more than eight feet thick. One may likewise, and it is even preferable, as Gaudi himself observes in his subsequent pages, not to dig a ditch to the traverse, in order that the passage may be more clear, but to raise it with sods, in case the principal ditch of the work should not supply earth sufficient for its construction. For further security, the entrance of the work is generally masked with one row or two of chevaux de frize. Trous-de-loup, or abbatis, may likewise be placed in front of the entrance, but in this case care must be taken to leave a free passage for the garrison.—TRANSLATOR.

feet, if the earth was newly cast up. The thickness of the parapet may, therefore, be easily determined; and, upon an average, twelve feet ought to be adopted, in order to resist cannon shot. When the post is of essential consequence, it may be made fourteen feet thick.* The berm may be either two or three feet broad, according as the soil is of a clayey, or of a loose sandy nature. In general, the ditch is made as wide as the parapet is thick; so that if the breadth of the parapet is twelve feet, that of the ditch is the same; the banquette is four feet. (Vide Plates 4 and 5.) In number 4, the parapet and ditch are twelve, the berm two, and the banquette four feet;

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* It may easily be conceived, that parapets 12 or even 14 feet thick could not resist the effect of cannon ball, if 18 or 24 pounders; but as pieces of this calibre are seldom used except for the attack of a post of great importance, the parapets may generally be constructed of the thickness recommended by Gaudi.

I shall only add, that the importance of a post is not the only reason for increasing the thickness of the parapet, although it may be a great inducement, as a post of great importance may be attacked with cannon of a superior calibre. The nature of the ground will occasionally render this measure indispensable. The same will take place with regard to the breadth of the berm.—TRANSLATOR.

but

but in number 5, the parapet and ditch are fourteen feet, the berm three, and the banquette four.

SECT. XI.

The above proportion between the thickness of the parapet and the breadth of the ditch is pretty right, when the former is intended to be six feet high, and the latter six feet deep, which is sufficient for field works. When the intention is to give them more extensive dimensions, other proportions are found out by means of calculation; however, that being rather the business of a mathematician than of an officer of foot, the above dimensions may be adhered to with safety.*

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* In field fortification, the greater width of the ditch is always attended with some advantage. The enemy stands more discovered on the edge of the counterscarp; when they attempt to fill up the ditch, it requires much more time, and consequently they are much longer exposed to your fire, from which they have more to suffer on account of its being near. There can be no apprehension, therefore, of making the ditch too wide, but attention must be paid to the time, the number of hands, and the quantity of earth wanted.—TRANSLATOR.

SECT. XII.

The ditch is never to be made less than six feet deep; but should there happen to be either stones or springs to prevent digging, the breadth of it then should be increased, to procure earth enough for the parapet.* The parapet of the traverse, or fleche which covers the entrance of a redoubt, need only to be made about eight feet thick, and the ditch eight feet broad.

SECT. XIII.

The faces of square redoubts can have only their own fire to trust to, as they are not defended by any other part; which inconvenience, however, may be in some measure remedied, by placing them so as to procure some little advantage from their situation; as, for instance, by constructing them on heights, by having one or more sides covered by a river, moor,

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* When a work has no flanks of its own, the ditch can never be too deep; for as it cannot be defended from the work, its depth is the only obstacle which it opposes to the enemy. In those that are flanked, the depth must not exceed $7\frac{1}{2}$ feet, in order that the bottom may be well discovered.—TRANSLATOR.

valley,

valley, &c. or by strengthening them with abbatis, chevaux-de-frise, trous-de-loup, fougasses, &c. &c.

SECT. XIV.

Before you begin tracing a redoubt, you must examine carefully which is the quarter the most exposed, or on which side the enemy can approach with greater facility. It is well known, that an angle is always the weakest part of a work,* therefore it ought never to be turned on that side, but one of the faces should constantly be opposed to it. You may see in Plate 6, that the face *a b* masks the defile *e*, towards which the enemy might advance by the two roads *d* and *c* in Plate 7, the face *f g* defends the ravine *h* on the left, and the face *g i*, the ravine *l* on the right.

Such works as are intended to oppose the passage of a defile must always be within musket shot, otherwise the time employed in constructing them would be entirely lost, and

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* When the parapet of the redoubt is made *en cremaillere*, this does not take place, because a direct fire is then made along the capital, as we shall explain hereafter. TRANSLATOR.

the enemy would pass in the very face of the garrison.

SECT. XV.

It is not necessary in the least, that redoubts should be traced exactly square; they are equally serviceable when made in form of a rhomb, as in Plate 8, fig. 1, or with one side longer than another, as in fig. 2 of the same Plate; far from being defective, this method will become of absolute necessity, if the ground neither requires, nor allows works to be exactly regular. In general, the ground on which they are to be constructed, and that lying near them, should determine their figure. If, for instance, a work is to be constructed on a height, care must be taken that every line is so disposed, that the slope of the hill all around, even to the very bottom, be open to the garrison's small arms. When you can gain such an advantage, it is of no consequence whether you have four or more sides to a redoubt (vide Plate 9.); the essential point, is to be able to defend every part of the ground properly; to require perfect regularity, in such cases, would be a mere display of pedantry.

SECT. XVI.

There is another method which may be practised,

practised, to prevent an enemy's passing a defile; this consists in having a double or cross fire, which may be obtained in two different ways: first, (vide Plate 10,) by constructing the redoubt, with the face opposed to the defile tenailled, that is to say, forming a re-entering angle *a*; by this means it is defended by the fire of the side *a b*, also by that of the side *a e*, so that the enemy will be unable to pass through the village *d*, over the bridge *c*, and the dam *f*, which form the defile, any other way than under the fire of the musketry.

The second method is to defend the defile by two redoubts, (vide Plate 11,) whose faces *a* and *b* defend the passage, flanking each other at the same time. A farther security may be procured by joining the redoubts with a line *d*, leaving a passage of thirty or forty feet at each extremity, *e*——*e*; so that if the enemy should unfortunately succeed in forcing the defile *x*, troops may be immediately marched to drive them back, and be able afterwards to regain their post. These passages, instead of being covered by traverses, as in redoubts, in order to facilitate such sorties or sallies, are simply closed up with chevaux-de-frise, which may be removed at any time.

Some

Some cases may occur, when it will be necessary to strengthen redoubts of this kind by lines, carried on as far as where the access is nearly impracticable, to prevent the enemy's turning them, and attacking the garrison in their rear. A line, for instance, may be added from the redoubt on the left, to the morass *f*, through which runs a small brook *h*; another line may also be added from the redoubt on the right to the deep ravine *g*, that covers its flank, and in which the trees are all to be cut down. When such lines as these are used to strengthen a work, you must be cautious not to extend them beyond musket-shot, or above three hundred paces; but if the distance they require being carried to, should prove greater, a cross-fire then must be obtained by breaking the line, and this of course will improve the defence. In the construction of works intended to dispute the passage of a defile, you must always endeavour to present, if possible, a greater front to the enemy than they can occupy in making the attack.

SECT. XVII.

We have several other works, which are of essential service for defending the passage of a defile, and which indeed deserve the preference,

rence, when unprovided with cannon. For instance, the *redoutes-en-crémailliere*, in which the inside line of the parapet is broken in such a manner as to resemble a pot-hook, or the teeth of a saw: their advantage consists in rendering the passage of the defile more difficult, by means of opposing a greater fire than common redoubts do. *

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* I have observed, (note 3 of maxim 4,) that in general the men fire directly forwards, without taking their aim, from whence it proceeds, that in common redoubts there is a considerable space at the point of each salient angle which is battered by no direct fire, which will be easily discovered by drawing the lines of fire of one of those redoubts. From a calculation made to determine that space, it has been found that, supposing a redoubt, the parapet line of which is 40 toises, only 6000 square toises of ground around that redoubt are exposed to its fire, whereas 70,714 toises and upwards are not exposed.

Some engineers, with a view of remedying this inconveniency, have proposed to make those angles round, which would indeed distribute the fire effectually on all sides; however, as this measure could not be carried far without lessening the capacity of the work, it was found that the fire was not of great execution, but very diverging.

Others again have proposed to cut off the angular point of those angles, in order better to defend the capital, which being the most distant from the flanking parts and the lateral fire, stands in the greatest need of defence. Notwithstanding

They are constructed as follows. If two hundred and forty men, or one hundred and twenty file are appointed for the defence of such a work, you have thirty file to each face. Trace a square redoubt, *a*, *b*, *c*, *d*, (Plate 12.) let each face be thirty paces with an angle presented to the defile. Now divide the faces *a b* and *a d* into as many parts, twelve feet each, as those faces will allow, and mark the divisions with small pickets *e*, but remember always to begin at the angle *a*. Then construct a fleche upon each of these divisions, the faces of which are eight feet and a half. To perform this operation with facility, use the cord mentioned in the first section; take seventeen feet of it, the sum of the two faces of the fleche, fix the

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withstanding those two measures lessen the inconveniency, yet they are insufficient to remove it entirely: it has been consequently imagined to trace the interior part of the parapet in the form of *crémailliere*, observing that one of the faces of the fleches which form the *crémailliere* be perpendicular to, and the other run parallel with the capital, so that lines of fire will be obtained from each of the faces, and from the salient angle of those same fleches; which will become obvious if the lines of fire be drawn from those points, Plates 12 and 13. These redoubts are indisputably far superior to others, but as the construction of them requires a great length of time, they cannot always be made use of.—TRANSLATOR.

extremities

extremities at the ends of each division, stretch the middle of it out, towards the front, and mark the angle of the fleche with a small picket, as expressed very distinctly in the plate. Next trace outwards a line, determining the thickness of the parapet, parallel to *a b* and *a d*; this must be at least fifteen feet, that it may not be too weak at the salient angles of the fleches. Two feet will be sufficient for the breath of the berm: the ditch must be twelve feet wide and six deep, that you may have earth enough for the parapet. The banquette is made parallel, not to the *crémailliere*, but to the faces *a b* and *a d*. (Vide Plate 13.)

July 7th 32.

SECT. XVIII.

Sometimes redoubts are made quite open in the rear, in order to defend such defiles in front of a camp as are too distant to be battered by the musketry fire of the line. These redoubts are also constructed to sustain the advanced posts on the farther side of the defiles, or to afford them protection if forced to retreat, by preventing the enemy from pursuing them. They are likewise to be erected on heights, or eminences, within reach of the cannon of the line, that the enemy may not

hold

hold the possession of them. Particular care must always be taken to support the detachments that defend them; however, if they should chance to be forced, the enemy can gain but very little advantage, as they are entirely exposed to the fire of the camp, as the work is not closed in its rear; yet a row of chevaux-de-frise should be placed in the opening, well fastened together with chains or cramp-irons; but in case wood cannot be procured to make the chevaux-de-frise, then you must dig trous-de-loup along the rear, to be protected against a surprise in the night. The nature of the ground will determine the figure of those works, and according to the number of men appointed to defend them, you will take proper dimensions. (Vide Plate 14, fig. 1, 2, 3, 4.)

SECT. XIX.

If you wish to construct a star-work, you must first trace the parapet line of a square redoubt, and divide each face into two equal parts, which you mark with small pickets. From these pickets draw a perpendicular line towards the centre of the work; this line is to be

be exactly an eighth of one of the faces.* This operation is minutely expressed in the plate, (vide Plate 15) for the use of those officers, who, being unacquainted with geometry, might find these directions rather too abstruse. Let us suppose the garrison to be composed of two hundred and fifty-six men, or one hundred and twenty-eight file, which divided by four will make thirty-two file, and consequently as many paces for each face of the redoubt *e f g h*. The eighth part of each face is four paces, which being set off from their centres towards the middle of the work, and the extremities *a b c d* marked with pickets, you trace lines from these pickets to the angles *e f g h*, which form the line of the parapet of the star-work. The parapet, the berm, and ditch, follow the same proportions as above directed, traced outwards parallel to the star, as well as the banquette withinside. In these redoubts you obtain a cross fire, and you have the advantage

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* Gaudi only speaks here of the square redoubt: but when pentagon and hexagon this perpendicular must have other dimensions. But as he observes himself that these works are in general defective, it would be useless to expatiate any longer upon them.—TRANSLATOR.

that

that the lines mutually defend each other. The entrance is to be made in that part which is the least exposed to be attacked, and always in a re-entering-angle. If you cover it with a traverse, this must be broken in the like manner as the face which stands before it.

We have been supposing that thirty-two file were to line each face in the first trace of the square; but as by forming the star we have increased the line of the parapet, it might be thought that the garrison would be insufficient; the difference, however, is but very inconsiderable: you need but open your files a little more than usual, to render it imperceptible, and the defence will be equally good.

SECT. XX.

You may construct other kinds of star-works by using the following method: trace first a square-redoubt *a b c d*, (vide Plate 16, fig. 1,) divide each face into three equal parts, and trace out an equilateral triangle *e f g*, on the centre divisions of each.* On account of this operation the line of the parapet is increased one fourth; you must, therefore, first

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* An equitateral triangle is that whose sides and angles are equal.

of

of all, make a proper calculation, because, in tracing the square, three-fourths only of the garrison are to be considered. Let us suppose that garrison to consist of one hundred and sixty file: when you trace the square as the foundation of the work, you must allow only one hundred and twenty file, or one hundred and twenty paces to the line of the parapet, which makes thirty to each face; the fourth part, or forty file that remain, are to be placed in the equilateral triangles, when you have completed the star-work, ten file to each triangle. The entrance must be made in a re-entering-angle *h*.

SECT. XXI.

There is another method of constructing star-works. Trace out first an equilateral triangle A B C; (Plate 16, fig. 2;) divide each face into three equal parts, and then proceed as in the example above, constructing small equilateral triangles on the centre divisions. When you determine on the dimensions, remember that the fourth part of the garrison is also to be left to man the three triangles when the star-work is completed.

SECT. XXII.

We have works of the same kind that

assume many different figures, but they are all of them nearly of a like nature with those I have been describing above; and I am very sorry to say, of more shew than of real utility; for although it is not to be doubted that the lines of all field-works should be broken, in order to procure a cross-fire, yet it must be owned that stars constructed methodically offer no real advantage from the regularity of their figure, and should be considered as objects of mere speculation. It is certain that they are of much less utility and service than those works whose both sides and angles are unequal, but from which every surrounding object may be entirely discovered, and therefore defended in a direct line and by a cross-fire. Redoubts with such very important advantages will always be able to make a good defence.

To illustrate this more fully, let us suppose an eminence upon which a large work is to be erected: the chief points to be observed in fortifying such a work will be, that the different sides or lines it is to consist of be so disposed as in general to follow the *contour*, or edge of the eminence, that the view every way be free and uninterrupted, in order to prevent the enemy from approaching under cover, and consequently

quently occasion a greater loss of their men when marching to the attack. To gain this point it is necessary to destroy all the houses within a certain distance around; also to cut down all the trees and thickets that might screen their movements. Where the slope of the hill is gentle (vide Plate 17, a long faint shade *a*), the lines of the work must flank each other to render at once the defence better, and the attack more hazardous; but where the access is extremely difficult on account of the great steepness of the hill (vide Plate 17, a short dark shade *b*), or a defile lying at the bottom, nature then has done so much that there is no occasion for art to interfere, and a cross-fire becomes totally useless. In this case a simple line will be sufficient to protect the garrison from the enemy's cannon; which it would be greatly exposed to if they did place any on the height *d*, on the opposite side of the brook *c*: a ditch before this line becomes even unnecessary, as the earth wanted to form the parapet may be taken from the interior part of the work, by which means the troops sooner get under cover, as if in a trench.

The small wood *e* which stands on the left must be cut down, in order that the enemy

may not conceal themselves either within or behind it. The dam *f* between the two ponds *h* must also be cut through, and the sluice in the other dam *g* be shut, in order to overflow the neighbouring fields. By thus taking every advantage of ground, you are sure of making your post more respectable.

SECT. XXIII.

Têtes-de-pont are occasionally constructed to cover bridges of communication, or to contain troops destined to protect the manœuvres of a corps, either when forcing the passage of a river, or repassing it in their retreat. The first thing to be done on these occasions, is to ascertain whether the enemy can approach the bridge by one, or both sides of the river. In the first place a tête-de-pont must be constructed on that side where the danger is most apprehended; and in the latter, works which mutually flank each other must be erected to cover both sides of the bridge. These are made of different forms, a simple fleche (Plate 18, fig. 1,) with the faces *a* and *b*, reaching close to the edge of the bank will be sufficient, if you have only to defend a bridge of communication, where you are not under great

apprehension

apprehension from the enemy.* The entrance *c* is practised in the face least exposed; you may sometimes, even in this case, construct fleches on both sides of the river (fig. 2).

SECT. XXIV.

When a corps advances to force the passage of a river, the troops that compose the van guard generally pass in boats, and are supported by the fire of the artillery. When they have reached the other bank they construct with as much expedition as possible a work to cover themselves, (vide Plate 19) in order that a bridge may be constructed with safety, for the passage of the main body and rear. This operation should be protected by part of the van-guard posted behind woolpacks provided for the purpose. These are generally about five feet high, and fifteen inches diameter.

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* This work affords but a weak defence, insomuch that it has no flanks, and that a considerable space in front of the salient angle is not defended. I would rather upon such occasions construct a work of a semi-circular form, or at least defend each of the faces of the fleche, with a piece of cannon placed on the opposite bank.—TRANSLATOR.

SECT. XXV.

Such têtes-de-pont as are intended to cover the retreat of a corps must be made much more extensive, and their lines so disposed as to flank each other. At the same time batteries must be erected along the opposite bank of the river, to protect the retreat of the main body; to flank the work destined to prevent the enemy from making a successful attack upon the garrison as they are leaving their post to form the rear guard, and to cover the men who are employed in burning, or breaking down the bridge. That part of the river which forms a re-entering-angle, if any such, should be preferred for the construction of the tête-de-pont, in order that the flanks of the corps, likewise those of the work, may be covered by the curve of the river. (Vide Plates 20 and 21.)

SECT. XXVI.

Sometimes an additional security is procured by throwing up lines along the opposite flank of the river, behind which infantry are placed to protect the flanks of the tête-de-pont, the retreat of those who defend it, and the men

while

while they break down the bridge (vide Plate 24). These lines, however, are very unfrequently constructed, unless it is apprehended the troops will be harassed in their retreat.* If there should be any probability of the

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* In order that those lines should produce the desired effect, at least with regard to the musketry, the river must not be very wide, and the bank on which they are constructed must be more elevated, or at least equal in height to the opposite shore. The lines then may prove of essential service for the defence of the work, nay even simple detached flanks, their effect being so much the more certain, that the soldiers fear less being attacked behind them.

But if the river should be thirty or forty toises wide, or that the bank being too low should make it necessary to keep at that distance, as the musquetry of those lines, or of the detached flanks, would not reach sufficiently beyond the salient angle, it could only be relied upon to protect the faces *a*, *b*, which cover the flanks *g*, *e*; or at best, for the moment, when the enemy approach the ditch.

Now let us suppose the width of the river to be considerable, such for instance as the Rhine, the Danube, &c. &c. which in some parts are upwards of one hundred toises wide, it is evident that the fire of the musketry from those lines, or detached flanks, can be of no use for the defence of the tête-de-pont, and can only be of some service to oppose the passage of the river, but the fire of the artillery will then supply the deficiency; and although it may be imagined that, rigidly speaking, it cannot be of

enemy's advancing in force on both sides of the river, works then must be constructed on each bank, so as mutually to protect one another (vide Plate 23).

SECT. XXVII.

When you wish to trace a tête-de-pont, you first lay down the base *a b*, and erect a perpendicular *c* on its centre, of the length marked in the Plates. The rest of the operation is very simple. Use the scale annexed to each Plate to measure the dotted lines, and trace them on the ground; they will shew each angle, and consequently the whole figure.

All these operations are made by means of the cord mentioned above (page 39), and its scale.

SECT. XXVIII.

If you are under the necessity of covering

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indispensable necessity only in that case, yet, if it is considered, that it is the most proper arm to defend the approach towards *works* from a distance, and that great advantage is always derived from stopping, when possible, the enemy from a distance, it will be allowed that artillery is of no less utility on the two former than on this latter occasion.—TRANSLATOR.

the

the retreat of an army over a river by five or six battalions, you must then construct a work proportioned to the strength of that garrison,*

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* With regard to the size of the têtes-de-pont, in general, the number of men intended for their common guard is a smaller consideration than the number of troops that are, or that may be advanced, as it is necessary those troops should be able to file without confusion, and that those posts besides must contribute to favour their retreat.

These têtes-de-pont are to be considered only as works of little more service than to prevent a coup-de-main, and of mere temporary utility, since they serve only for a few days, or at most during the course of one campaign. Some are constructed for a more permanent use, but as they belong rather to permanent than to field fortification, I shall abstain from making any mention of them in this place.

It is not necessary always to use connected intrenchments to cover a bridge; for detached works frequently answer the same purpose. For instance, in front of a bridge redoubts may be constructed, which flank each other, and from which a cross fire is procured. The two bridges which the Austrians had thrown across the Rhine at Mulhem, (during the last war,) were covered by three redoubts, which mutually flanked each other, and which, moreover, were flanked by batteries erected on the opposite shore. I followed the engineer who traced them in his operation, and from the observations which that circumstance suggested, I would prefer that kind of tête-de-pont to a connected intrenchment to favour the retreat of an army, as, indeed, I am sensible, that by this means it would be effected with as much security and more ease.--TRANSLATOR.

and

and pay great attention to have the flanks well defended, the same as in all têtes-de-pont. In great works of this kind the flanks may be made *en-cremaillière*, to obtain every where a cross fire, but you need not follow the same method as in the construction of *redoutes-en-cremaillière*, which have only right-angles: in this case it is far better to make your angles a little obtuse (vide Plate 22), in order that your cross-fire should be more oblique. It is only requisite that the flanks should be broken, otherwise they would be too long, and accordingly ill defended. The better to secure the retreat of the battalions that defend an extensive tête-de-pont of this kind, a small work, to contain three or four companies destined to form the rear-guard of the whole, is constructed within it, close to the end of the bridge, and of which the parapet must always be three feet higher than the outward work, that it may command it.

SECT. XXIX.

After a corps, or army, as well as the greatest part of the troops that garrisoned the tête-de-pont, have repassed the river in presence of the enemy, so that only two or three companies

panies remain; it is very likely, when these have also retired, that the enemy will endeavour to oppose the bridge being lifted, the pontoons being replaced on their carriages, and in short will exert their utmost efforts to render even the attempt ineffectual. In this case it is indispensably necessary these companies should remain in the tête-de-pont until the bridge is demolished, to prevent the enemy's approach by their fire; and that they may retreat in safety, care must have been taken before-hand to provide two rafts to transport them across the river as soon as they quit the work. These rafts are made as follows: You must collect as many beams, joists, and planks, (fir, if possible) as will, when framed and put together, contain room enough for a company to draw up upon; then fasten the joists across the beams, by means of strong wooden pins, and have the planks nailed above the joists: next have a ledge of wood, about six inches broad, put round the whole, and take care the seams are every where well pitched, to keep out the water. Lastly, there are woolpacks to be laid along the sides of the rafts facing the enemy, supported by pickets nailed to the ledge.

The

The two above-mentioned companies get behind this kind of breast-work, and gain the opposite bank either by means of oars or of a rope, firing at the enemy all the while. Their retreat is covered by the artillery, and the infantry on the opposite side.

This rear-guard might also pass the river in large boats, but with much more danger from the fire of the enemy than on rafts, such as we have been giving a description of. Their retreat might be rendered still more effectual by mining the tête-de-pont and blowing it up the moment the last of the rear-guard have quitted it.

SECT. XXX.

In the construction of intrenchments, the parapet should be equally thick, and the ditch equally wide, as in other works; but it is not easy to determine their figure: the only just direction depends entirely on the ground, the nature of which continually varies, and must accordingly regulate the dispositions of the lines and angles to be traced. This makes it obvious that all regular intrenchments, whose sides and angles are equal, cannot but be very defective where the ground is uneven. Nevertheless,

theless, there are some maxims, or general rules, which I shall reduce to eleven, viz.

I. The angles should neither be too acute, nor too obtuse, relatively to the lateral works, in order that:—

II. Every line may be defended by the fire of another, within musket shot.

III. If the ground is very uneven and irregular, the lines must be so disposed, that the slopes, and even the bottom of every height, be entirely discovered.

IV. However, if owing to great steepness, or to the ground being interrupted by numbers of small eminences, or cut with deep ravines, the above rule should become impracticable, then you must contrive, as much as lays in your power, to flank the parts concealed, with other lines.

V. The flanks of the intrenchment should be well secured, that the enemy may not be able to turn them.

VI. Those parts where an attack appears most practicable, deserve and call for particular attention: every obstacle that can be thought of must be used to oppose the enemy; namely, chevaux-de-frise, palisades, trous-de-loup, abbatis, fougasses, &c.

VII. When

VII. When the ground is broken by heights, or vallies, salient angles must be made upon the former, and supplied with artillery; and re-entering angles in the gorges, in the small vallies, in short, in those parts where two heights form a narrow bottom.

VIII. You must be careful to construct close redoubts at certain distances, so that in case the enemy should force any part of the intrenchment, yet they may not be able to resist the fire which takes them in flank, but presently be compelled to give up every advantage they may have gained, and to retire.*

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* There is no doubt but that closed redoubts constructed at a certain distance from each other, as mentioned by Gaudi, are in many respects of essential service. As they stand higher than the neighbouring parts, and are placed in the most advantageous situation, either because they sally forth, or on account of the more elevated ground, they protect the neighbouring parts, and become shelters within reach, under the fire of which the troops, either repulsed or broken, may rally. Besides, it is not uncommon, when a brisk and obstinate attack is made, that you are forced to quit a battery, which you retake a little after: but unless the enemy are very incautious the cannon will be spiked. By means of these redoubts, or of some other closed works, such inconveniences would occur much less frequently.

Now, if the enemy should succeed in making themselves

IX. If the ground is not chosen in such a manner that no part of the intrenchment, either in front, or on the flanks, may be commanded by any adjacent heights, the troops must never think of making the least movement with safety.

X. It is necessary to leave here and there openings of thirty or forty paces, that the troops may advance in front.† These should

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selves masters of one or two of those works, then the loss of the intrenchment is almost certain, owing to the difficulty of dislodging them: the construction and position of them, accordingly, must be paid particular attention to, not only to secure them against a *coup de main*, but to render the access, if not impossible, at least extremely difficult.—TRANSLATOR.

† Openings of the breadth proposed by the Author would be extremely dangerous, in the first place, because, as its retrenched situation will make it probable, that the army acting on the defensive is far inferior in number to the enemy, intervals of such magnitude would induce the assailants frequently to attempt surprising the garrison: on the other hand, because the cannon of the besiegers could often batter *en echarpe* the interior of the intrenchments, which would throw that same garrison into great confusion. I therefore believe, that openings of twelve or fourteen paces are quite sufficient, since a column may march through very easily.

Perhaps it will be objected that such small intervals would

never be made in salient, but always in re-entering-angles, covered either with fleches or traverses, or closed up with chevaux-de-frise.

XI. If the roads in the rear of an intrenchment be not naturally good, they must be made so immediately, in order to facilitate the retreat, if circumstances should require it.

In order to illustrate the above maxims, I shall introduce the following example. (Vide Plate 25.)

The right flank of the intrenched camp is covered by a deep marshy vale *a*, through which runs a muddy stream that is impassable. The right wing occupies a hill, on which a

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would be too narrow for the cavalry: which argument I shall retort, by observing, that on account of the swiftness of their movements, they will pass much quicker than the infantry: and I persist in my opinion, that the openings ought not to exceed fifteen paces. I would rather increase the number of them than their width: I would also prefer to cover those entrances with fleches than with traverses.

With regard to the chevaux-de-frise which Gaudi places frequently in front of the works, and which the artillery may so easily destroy, I would only wish them to be used to close the gorges of the works, or in the ditch. TRANSLATOR.

redoubt

redoubt *b*, is erected, the *contour* or edge being exactly followed, in the disposition of the lines, the small wood *c*, in front of the redoubt, must be cut down, in order to clear the view. On the left of the hill, just at the bottom, stands the village of Weilheim, with two fleches erected in its front, and joined by the line *d*. Bridges of communication *e*, are laid over the brook, that the redoubt *b*, upon the hill, may receive immediate support from the camp. In front of Weilheim is a gentle ascent *f*: the village of Mansfeld, which lies at the bottom of it, is entirely surrounded by defiles, and hollow-ways *g*. This height, which serves for an advanced post, is fortified with a redoubt to contain four hundred men with a few pieces of cannon, and only closed in the rear with chevaux-de-frise, in order that, if the garrisons should happen to be forced, the cannon of the intrenchment may soon oblige the assailants to abandon the post, which is occupied at first with no other view than to prevent the enemy taking possession of it in the night, and erecting there batteries that would annoy the camp. The intrenchment *h*, is carried along the heights from Weilheim to Stemern, according as the ground directs, and constructed in such

a manner that all the different parts mutually defend each other; some close redoubts *i*, are likewise erected here and there in the line of the intrenchment. The entrance into Stemern is covered by a redoubt *l*, open in the rear, and commanded by the heights above the village. The small wood *m* in its front is cut down, that the view may not be confined, and that the fire of the works may have their full scope.

The intrenchment is continued from Stemern to some high hills covered by a thick wood *n*, which protects the left flank most powerfully, on account of its being nearly impassable; yet for farther security, a large abbatis *o*, is formed exactly across the wood, defended by piquets of infantry *p*, placed at certain distances from one another. The gorge or opening in rear of the left wing, is covered by a redoubt *q*, constructed on a rising ground, and a line of communication *r*, is carried from this work to the left of the intrenchment. There are several openings *s*, about thirty paces wide, left in the lines, and closed with chevaux-de-frise, that if the enemy should happen to be repulsed, some cavalry may be immediately sent in their pursuit.

The

The troops *t*, are of course encamped behind the intrenchment; the infantry forms the first line, and the cavalry the second. Two battalions occupy Weilheim; Stemern is only occupied by one. There are four roads *u*, *x*, *y*, *z*, in rear of the camp, by which, if necessary, it is easy to make a retreat.

It must be allowed that the fortifying of posts of this kind is generally committed to the care of an engineer; however, an officer who is desirous of obtaining a perfect knowledge in ground, and distinguishing himself in his profession, will study to procure an idea of the manner in which these kind of works should be executed.

CHAPTER II.

Of the necessary Materials.

SECT. I.

THE fascines, or saucissons, commonly used in field-works, are ten feet long, one foot in diameter, and made as follows. Stick six small pickets into the ground, two and two, in the form of little crosses, well fastened in

the middle with twigs of willow or of birch. The branches are then laid on these threstles, or little wooden horses, and bound round, from end to end, with withes. Six men are employed in making a fascine, two cut the boughs, two gather them together, and the other two bind them. They can make twelve in an hour with great ease.* The fascines are laid in the direction of the lines which form the parapet, or other parts of the work, and then fastened to the ground, and to one ano-

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* It is impossible for six men to make more than 7 or 8 fascines in an hour, if they pay every attention required; that is to say, if the twigs are well interwoven, the fascines bound tight and without prominencies, and if they give them their exact dimensions; this latter point is of the greatest importance, for if the exactness in the dimensions is not adhered to, it is impossible to ascertain by calculation the number of fascines wanted for the lining of a work. In order to ascertain the dimensions, when fascines are making, on the right and left of the fascine bench two pickets *d*, *e*, (vide Plate 40. supp. 1, fig. 2,) are planted at twelve feet distance, which give to the workmen the exact length of the fascine; next a chain or cord is used, the length of which is equal to the intended circumference of the fascine, and at the extremities of which, are fixed two round sticks about two feet long and one inch diameter. This chain or cord *g*, is called *choke*. By means of these two sticks, two men are enabled to bind the twigs fast, and reduce the

fascine

ther by means of pickets three or four feet long, an inch and an half in diameter, and pointed at one end. They form a facing that supports the parapet, which otherwise would be liable to tumble down, on account of its weight.—For works *en-cremaillière* the fascines are made no more than eight feet long.

To fasten the fascines, five of the above mentioned pickets only are required.

SECT. II.

If wood should happen to be scarce, sods will answer the same purpose, and may be used to line the parapet. They are cut about a foot square, and four inches thick.

SECT. III.

Fraises are made eight feet long, five inches broad, and sharp at one end. The beams laid along the parapet are twelve feet long, and six square inches thick; to these the fraises are

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fascine to its proper diameter, which previously is two inches above it at least. The twigs of willow or of birch, which are commonly used to tie the fascine, must be tough and pliable. All the knots which fasten the bands must be turned on the same side of the fascine.—TRANSLATOR.

fastened with nails seven inches long. A couple of hands will make twelve fraises in an hour.

SECT. IV.

The palisades which are used to fortify the ditch, are nine or ten feet long, six inches broad, and pointed at one end. (Vide Plate 29, fig. 2, 3.) But if a sufficient number cannot be had with these dimensions, smaller ones may be used, but then they must be properly intermixed with the larger.

SECT. V.

The stakes that are placed in the trous-de-loup, must be six feet long, about four or five inches thick, and sharp at one end.

SECT. VI.

The beams of the chevaux-de-frise are twelve feet long and six square inches thick. The fraises, which are run cross-wise through the beams, are seven feet long, four inches broad, and placed six inches asunder. Chevaux-de-frise are used to shut up the entrance of redoubts, gate-ways, and other passages. Sometimes they are placed along the border of the ditch, or in the bottom of it. (Vide Plate 29. fig. 4.)

SECT. VII.

Gabions are made of different dimensions. Those used in field-works are generally three or four feet high, and two or three feet in diameter. In order to make them, some pickets three or four feet long are stuck into the ground, in form of a circle two or three feet diameter, wattled together with small branches, in the same manner as common fences. (Vide Plate 40, supp. 1, fig. 4, 6.) They are filled with earth, placed near each other, and form embrasures for the guns. *

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* Gabions being frequently used, and particular attention being required to construct them with a certain degree of perfection, I think it necessary to explain more minutely than Gaudi has done, in what manner they are to be constructed. First drive a picket into the ground, to which you tie a cord of the length of half the diameter you wish to give to the gabion, and at the extremity of which cord, is fixed another small picket with one of its points blunted. By means of the cord and of this latter picket, you describe on the ground a circumference, along which are placed seven or nine pickets, three or four inches higher than the gabion is to be made, and the blunted point of which is driven a few inches into the ground so as to keep steady. When the pickets are thus placed in their proper direction, in order that they should retain it whilst the gabion is making, they must be bound quite at top with a strong

Other gabions are made about one foot high, twelve inches diameter at the top, and about eleven at the bottom; these are placed along the top of the parapet to cover the troops while firing over it.

To make all the above mentioned materials,

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wreath of willow twigs wattled round these, and with another at bottom; you then proceed to strongly interweave the twigs from bottom to top, observing to drive them down from time to time with a wooden mallet, and as close to one another as possible. When the gabion is nearly half finished, the upper wreath which had been made at first becomes useless and even cumbersome; you must then drive it down, or remove it entirely: in short, when the gabion has very near its proper height, you finish it with a strong wreath of twigs, which you fasten as well as that at bottom with thinner ones which are run through the weaving and round the pickets, care being taken that the knots be turned towards the inside of the gabion. It is to be observed that the top of the gabion, whilst making it, becomes the bottom when it is completed. A gabion to be well made requires the twigs being evenly and closely interwoven, and the whole standing straight up. You might dispense tracing the circumference which has been mentioned above, if you had a round board similar to that represented in Plate 40, supp. 1, fig. 5. The diameter of that board is equal to that of the gabion to be made, and a sufficient number of notches have been cut round the circumference, to shew where the pickets are to be placed.

you

you must provide a number of wooden mallets, rammers, hatchets, and bill-hooks for cutting branches.

CHAPTER III.

Of the mode of calculating the proper quantity of each material.

SECT. I.

AFTER the dimensions of a work have been determined according to the strength of the troops appointed to defend it; the next calculation to be made, is the necessary quantity of materials for the construction of that work. It is to be observed that

1st—6 fascines are required to line five paces of the inside of the parapet.*

2d—4 ditto, to line five paces of the outside.

3d—2 ditto, to fascine five paces of the banquette.

4th—6 ditto, to each embrasure.

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* I prefer fascines 12 feet long to those that are only 10, because a smaller number is wanted, and of course the revetement is more solid. This solidity would be still increased, if the first row of fascines was sunk half a foot in a trench or gutter, dug on purpose at the foot of the parapet; and as the height of the talus exceeds the perpendicular height of the parapet, it is necessary when you reckon the number of fascines you shall want for the lining, to add one row for its height. As we suppose the fascines to be 12 feet long instead of 10, as Gaudi has stated, we shall reckon 6 for a distance of six paces.—TRANSLATOR.

SECT. II.

The preceding table will make it very easy to find out the number of fascines required. Let us suppose, for example, a redoubt is to be constructed to contain two hundred and forty men, or one hundred and twenty file, we shall proceed in the following manner.

1st. Six fascines being allowed to line five paces of the inside of the parapet, we will find that to line one hundred and twenty paces, it will require - - 144 fascines

2d. To line the outside, although 96 only are required, the same quantity as above is allowed, - - - 144

3d. We reckon to fascine the banquette, the fourth of what are allowed for the inside of the parapet, - - - 36

4th. In reserve to supply those that break, 30

Total 354 fascines

* Each fascine requires five pickets, - 5

Total 1770 pickets

SECT. III.

To find out the number of palisades that are wanted, proceed as follows.

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* As we suppose the fascines to be twelve instead of ten feet, each will require six pickets.—TRANSLATOR.

As

As they are made six inches broad, and planted three inches asunder, they consequently take up nine inches. The circumference of the work, measuring along the middle of the ditch, being found in paces, allow eight palisades to every three paces, which, at the rate of two feet to a pace, is six feet taken up by the said eight palisades. The circumference of the work being one hundred and fifty paces, four hundred palisades will be required, eight being allowed to every three paces.

SECT. IV.

The proper quantity of fraises may be calculated on the same principle. Each fraise being five inches, and the interval between them three, three fraises must be allowed to one pace, which is four and twenty inches; they are to be placed in such a manner as to hang over the berm and to reach beyond it. After having first ascertained in paces, the outside circumference of the parapet, the calculation then is made. Let us suppose it, for instance, to be one hundred and sixty five paces; three fraises being allowed to each pace, four hundred and ninety-five fraises will be required. You must also provide a similar number of nails

seven inches long. The beams to which the fraises are fixed, are twelve feet long; one beam therefore is allowed to eighteen fraises; or, to be shorter, a beam to every six paces.

SECT. V.

You will soon be able to find the proper quantity of materials required for the construction of a work, and with the greatest facility, if you do but accustom yourself to take paces about two feet wide, and this a very little practice will render habitual. It will even save much time and trouble, which otherwise the measurements alone, besides tedious long calculations, would require.

CHAPTER IV.

Of the construction of works.

AFTER all the lines of a work are traced out upon the ground, namely, the line of the parapet, the thickness of the parapet, the berm, ditch, and banquette, the workmen then set about breaking the ground, when the following principles are to be attended to most scrupulously.

SECT.

SECT. I.

A row of workmen *a*, are placed along the line that marks the berm, in front of the work, and a pace asunder, to throw the earth from the ditch towards the lines tracing out the parapet. But, previous care must be taken to lay a row of fascines along the inside line of the parapet *b*, and to fix them well with small pickets, in order to prevent the workmen from covering with earth the first traced lines. (Vide Plate 26, fig. 1.) Behind the first row of workmen, there is a second row *c*, upon the line, marking the outside of the ditch: these are about two paces asunder, and supply the first with earth, which these latter throw towards the work, with that they dig themselves; in the mean while some other ram it.*

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* Gaudi means here the workmen who are placed on the parapet, to ram the earth which is thrown up to them from the berm, and serves to make the parapet; but there must be another row of workmen to line the inside of it, in proportion as it is erected.

If the construction of the work did not require great expedition, the workmen on the berm might be placed at four feet distance from one another, and those on the counterscarp at eight feet.

It is very easy in both cases, to find out the number of hands

When all the rest is completed, then the traverse that covers the entrance is constructed.

SECT. II.

On both sides of the ditch, particularly on that next the work, there must always be a proper slope or talus, as the parapet would otherwise be liable to tumble down on account of its weight. When the ditch, for instance, is ten feet wide and six feet deep, (vide Plate 26, fig. 2,) the inward and outward talus must be three feet each. When the ditch is twelve feet wide and six deep, (vide fig. 3,) the slope or talus then is four feet; and if the ditch should be fourteen feet wide and seven deep, (vide fig. 4,) the talus then should be four feet and a half. The outward talus may be less

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hands that are wanted to dig the ditch and throw up the earth on the parapet; the whole operation consists in determining how many feet long the ditch is to be, and in the first case, to reckon at the rate of six men for every eight feet of that length, and in the second case at the rate of three.

Respecting the kind of necessary utensils, which are supplied from the park of artillery, or from the neighbouring villages, it depends, as the author will explain it, on the nature of the ground.—TRANSLATOR.

than the interior when the soil is either clayey or stony. The corners or angles are rounded, which gives additional solidity to the ditch.*

SECT. III.

The inside of the parapet is six feet high,

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* Gaudi, in this place, has adopted the opinion of Vauban, and fixed the talus of the scarp, and that of the counterscarp to one third of the breadth of the ditch. Notwithstanding such high authorities, I cannot abstain introducing some particular observations on the subject. It is obvious that the nearer the scarp and the counterscarp are being perpendicular, the more difficult is the ascent or descent of them; it would be very desirable therefore to construct them in that manner, which, however, is impossible, particularly the scarp, which having to support the pressure of the parapet, would infallibly tumble down. But I am convinced, and will make bold to affirm, that if the ground is good, the berm and a talus for the scarp, equal to half the depth of the ditch, will be sufficient to prevent the parapet from tumbling down. With regard to the counterscarp, it is beyond doubt, and the author himself allows it, that its talus may be lessened, especially if the work is to subsist only for a few days.

If, on the contrary, the soil is bad, or if the ditch is to be filled with water, the talus then must undoubtedly be augmented, for two reasons; in the former case, on account of the nature of the ground; in the latter, to prevent the degradation which the water might occasion —TRANSLATOR.

and

and the banquette one foot and a half; the soldiers therefore, when they stand upon it, are covered four feet and a half.* The an-

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* This height of four feet and a half for the interior side of the parapet, above the banquette, although generally adopted, appears to me rather too considerable. The advantages of a grazing fire are generally known. It is also known that the more the fire is fichant, the less it is dangerous; and that of course it always becomes more fichant in proportion as the point from which you fire is more elevated, unless the ground which is battered be on a level with that on which you stand. Every parapet above four feet four inches high, the general height at which a common sized soldier holds his piece when making ready, to fire in a parallel line with the horizon, is defective, and the defect therefore ought to be remedied as much as possible. I would even wish that this height of the parapet should be diminished according to the slope of its summit; this is a very essential circumstance, as, for instance, a soldier must be very near six feet high, to be able to fire sloping at eighteen inches per toise, above a parapet of four feet and a half; no wonder then if so many shots are lost in the air.

I am aware that circumstances will occur, when you are obliged, contrary to your own inclination, to increase the common height of the parapet; for example, when forced to cover yourself from an elevation, to plunge upon some low point, to cover the branch of a work by augmenting the height of the parapet near the salient angle, &c. &c. so as to prevent it being discovered or enfiladed. The closed works which are set within lines, may likewise be excepted from the rule I propose, unless they are so situated as to retain a superiority over those that are adjacent to them,

gles of a parapet should always be made about a foot higher than any other part, in order that the work be less exposed to an enfilade from the cannon of the enemy.

SECT. IV.

If the inside of the parapet is six feet high, the outside must be only four feet and a half; that the top may slope like the roof of a house, and the enemy be entirely exposed, even on the edge of the ditch. This proportion between

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them, and which must not be less than two or three feet. I must allow that the men are a little less covered, but although this inconveniency were not overbalanced by other advantages, I shall observe that the soldiers naturally lean down upon those occasions, so that their heads only are discovered above their piece; besides they may cover themselves with small gabions, which will protect them at least against the musketry.

This height of the interior side of the parapet above the banquette is quite sufficient, particularly for those works that have no flanks of their own, such as redoubts; or for others whose flanks are very oblique, as those sorts of works have the great disadvantage of not being able to defend their ditch.

With regard to the slope of the parapet, it must always be such, that from the inside of the work, whatever is done on the counterscarp may be discovered.—TRANSLATOR.

the outside and inside of the parapet becomes unnecessary if a redoubt be constructed upon a height, because then the top must have slope enough, and the enemy may be discovered at the very bottom of the hill.*

SECT. V.

The parapet would be liable to fall down were it not lined either with fascines or sods,†

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* From what is here said by the author, it becomes evident that the slope of the summit of the parapet most chiefly depends on the greater or smaller elevation of the work above the ground which is to be battered; now, as this slope generally determines the direction of the musketry, I conclude, that it will be more considerable, and the fire less grazing, in proportion as the interior side of the parapet above the banquette will be more elevated.—TRANSLATOR.

† *Hurdles* are seldom adopted for the lining of a parapet; nevertheless, I shall briefly explain the manner in which they are to be used.

Along the line of the parapet, and at one foot distance from each other, hedge-stakes are planted, the length of which must be such, that after their being sufficiently driven in the ground to hold fast, their height is equal to that of the parapet they are intended to line. In order to procure a proper talus they are driven in an oblique direction. The twigs are next to be interwoven, as has been done for the gabion, observing that the thin end be twisted round the outermost stakes, which renders the hurdle

which form a kind of revêtement to support it. If sods are used, lay them with

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hurdle more solid, and equal at both extremities, and will keep the twigs fast to the pickets.

The last twigs must be strongly fastened to the pickets, and secured by cross-bands. (Vide Plate 40, supp. 1st. fig. 3.).

As for the *sods* which are used for the lining, they must be about one foot long, one foot broad, and five or six inches thick, which latter dimension will be reduced to four inches when they are rammed together. The best are those that are cut in moist but good meadow land, where the grass grows thick, and the ground is overgrown with roots.

We shall now proceed to explain in what manner those sods are used to line the interior side of the parapet.

First, one row of them is placed at the bottom of that interior side, the grass lying downwards. If the sod be not equally broad throughout, the wide side must be turned outwardly, and the narrow side inwardly towards the parapet. This first row is fastened with pickets.

Next a second row is laid over the former; but care must be taken that each sod of the row above be laid on two of the row beneath, in such a manner, that all the sods be placed over one another, with alternate joints like the bricks in a wall. This second row is likewise fastened with pickets.

In the same manner you proceed, continually placing one row of sods above another, till the lining is made sufficiently high. Each row of sods, successively, is to be

STAATSBIBLIOTHEK BAMBERG

the turf downwards. If fascines are used, after the first row is laid, as mentioned above,

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beaten and rammed together to make them lie closer to one another, which renders the work more solid and more compact; when the last row has been placed, you cut away the whole with the proper slope.

If the parapet was intended to stand for a certain length of time, the roots of the grass may be laid between the sods, which will contribute to fasten them better on the roots growing.

Whilst some men are thus employed in lining the interior side of the parapet, others are placed on the parapet, where they spread out the earth evenly, and ram it well together. Lastly, when all the earth is finally overspread and rammed, the summit and interior side of the parapet are given the proper slope, and the whole is dressed off as smooth and even as possible.

Nothing is more easy than to find out the number of sods that are requisite for lining a work. The length of each sod being one foot, the lining of one side of the parapet will require as many sods as that side is many feet long: again, each sod being only four inches thick after it has been well rammed, you must reckon three sods for each foot of the height of that same side, so that if you multiply the number of feet the side is long, by the number of feet it is wide, three times the produce will give you the number of sods requisite to line that side: but as it often happens that some of them will break, one tenth of that number is generally allowed over and above.

It is reckoned that a soldier can cut one thousand sods

easily

all along the interior line of the parapet, and well fixed with pickets,* the earth then is thrown against them, a second row being laid on the first, and so on, in proportion as the breast-work is elevating. The following rules are to be observed:

I. The inside of the parapet must have a gentle talus to prevent its fall, which otherwise might take place, notwithstanding the sods or fascines laid to support it. A parapet six feet

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easily in a day. As soon as they are cut, other men are employed in carrying them into the work, the number of which is determined according to the distance. They may likewise be brought in wheelbarrows.—TRANSLATOR.

* I have already observed, that a lining of fascines would acquire additional solidity if the first row was six inches in the ground. Care must be taken that the ties of the bands be turned towards the inside of the parapet, in order that they may be covered with earth, and not break so easily: it is likewise adviseable to have the extremities of two adjacent fascines in the same row run into one another.

When you picket the fascines of the top rows, you must take care that the pickets do not strike against the bands of the row beneath, which would make them burst. The best method to avoid this accident is to place the fascines in such a manner, that the bands of those of the upper row may lie exactly upon those of the fascines of the row beneath it.—TRANSLATOR.

high requires only a talus of about one foot.*

II. The fascines must be laid in such a manner that the ends of those in the second row do not come exactly over the ends of those in the first; for if they did, the weight of the earth could not possibly be resisted. The ends of those in the first row are always to be covered by the middle of those in the second, and so on for every other row of fascines.

III. You must not drive directly downwards all the pickets that fasten the fascines, but some obliquely into the parapet, which will increase its solidity.

IV. The exterior side of the parapet, which we have stated above to be four feet and a half high, must have a greater talus than the interior

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* In order to retain the proper talus, you need but place the fascines in such a manner, that each row, beginning from the second, be placed a few inches more towards the inside of the parapet than that which supports it. This number of inches may easily be determined when you know the height of the parapet, and the slope you intend to give it. Here, the same as in the lining made with sods, when the fascines are laid, the workmen who are placed on the parapet spread the earth evenly and ram it well together.—TRANSLATOR.

side

side. If the parapet, for instance, is twelve feet thick, the outward talus should be from two feet and a half to three feet. The talus of the banquette must likewise be one foot and a half. The Plate, (27, fig. 1, 2, 3.) in which the proportions are exactly marked, will explain this fully.

A. B.	The horizontal line.	Dimensions of the parapet.
a.	Talus of the banquette.	
b.	Banquette.	
c.	Interior talus of the parapet.	
d, *e.*	Interior height of ditto.	
e, *f.*	Talus of the top of ditto.	
f, *g.*	Exterior height of ditto.	
h.	Exterior talus of ditto.	
i.	Berm.	
l.	Interior talus of the ditch.	Dimensions of the ditch.
m.	Breadth of the bottom of ditto.	
n.	Depth of the ditch.	
o.	Exterior talus of the ditch.	

SECT. VI.

When the soil is clayey it is not requisite to fascine, or sod, the outside of the parapet, but if loose, or sandy, it cannot be dispensed with. It must be strongly done, especially when the ground is stony, for if not, the garrison will be much more endangered from the splinters of the stone flying about when hit by the enemy's shot, than from the bullets themselves.

SECT. VII.

It is likewise proper to line the embrasures, which may be done with fascines, but sod is preferable, as not being liable to catch fire. They are eighteen inches wide withinside, and from seven to eight feet on the outside. The *genouillère*, or part of the parapet which covers the carriage of the gun, is two feet and an half high, reckoning from the platforms that are put under the cannon, that their fire may be more true: however, the height of the *genouillère* in general is proportioned to the size of the pieces. Great attention must likewise be paid to make the parapet on each side the embrasures of a sufficient height, that the artillery men may work the guns without being too much in the view of the enemy. The distance between the embrasures must be at least six paces (vide Plate 28. fig. 1.), that the *merlon*, or part of the parapet between, may be stronger, and offer more resistance to the cannon of the enemy.*

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* The tracing and constructing of the embrasures, of which the author gives but a vague and unsatisfactory explanation, being objects of great importance, I shall endeavour

SECT. VIII.

When you have any artillery to spare, you may make embrasures in the angles, especially

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deavour to supply that deficiency, and shall first add some definitions to those he has already given.

The opening of the embrasure, inside of the work, is called *interior opening*, and is represented by the line *e f*, in Plate 40, supp. 1, fig. 7.

That towards the country, and which is represented by the line *c d*, is named *exterior opening*.

The line *a b*, which running through the breadth of the parapet terminates at the centre of the two openings, is called the *centre line* of the embrasure. The direction of this line, and consequently that of the embrasure, depends on the direction in which the cannon is to be fired.

The cheeks are that section of the parapet which lies on the right and left of the embrasure. The lines *e c*, *f d*, mark their direction. The surface *c e f d* of the section of the parapet, comprehended between the openings and the cheeks of the embrasure, is called the *sole*.

The *heurtor* is a beam five or six inches square, which is placed at the foot of the parapet, and the direction of which, as I shall explain hereafter, depends on that of the centre line.

Let us suppose that the fig. 7, Plate 40, (supplement 1) represents that part of the parapet of a work in which the embrasure is to be made.

When the *genouillère* is high enough, that is to say, when

the

of square-redoubts; for as the angles are the weakest parts in those kind of works, by so

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the parapet is sufficiently elevated to afford the cannon and its carriage, placed on the platform, to fire with ease, and to be covered, you must then proceed to the tracing of the embrasures, in the following manner:—

You first take your alignment, with the principal point of the object you intend to batter, by means of two vertical pickets, namely, one at the point *a*, which determines the middle or centre of the interior opening of the embrasure, and the other at the point *b*, on the exterior side of the parapet. The straight line *a b* drawn between those two points will fix the direction of the centre line.

From the point *a*, draw both on the right and left two lines *a f*, *a e*, each nine inches long, to determine the length of the opening *e f*: a picket is to be placed at the points *e* and *f*.

If you next from the point *b*, draw *b d* and *b c*, both equal to three and a half or four feet, you determine the length *c d* of the exterior opening of the embrasure. Pickets are likewise to be placed at *c* and *d*.

If now the lines *c e*, *d f*, are drawn, they determine the direction of the cheeks, and complete the tracing of the embrasure.

This tracing being finished, you proceed to raise and to line the parapet of the *merlon*; but you must take care not to increase or lessen the openings of the embrasure, particularly the interior opening. If the lining is made with fascines, and that, in proportion to the space which is to be lined,

doing you enable the garrison to make a much better defence.

Platforms are laid under the guns if there be a sufficient quantity of beams and planks; but if these materials are scarce, one strong plank only is put lengthwise under each wheel.*

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lined, they should happen to be too long, they must be sawed very straight, and in a perpendicular line with their axis.

Equal care must be taken, when lining the cheeks, not to increase or lessen the openings; and if the lining be made with fascines, these must lay entirely and vertically over one another, on that of their extremities which is close to the interior opening, and gradually diverging towards the exterior, assume the shape of a fan: however, as the author observes, it is better to line them with sods.

When the parapet and lining are completed, you give a proper talus to the sole of the embrasure.

If instead of one single embrasure, as we have just supposed, several were to be constructed near one another, the same mode of proceeding is to be adopted; but you must mind to leave a sufficient space between them, in order that the cannon may be worked without obstruction, and that the merlons be not too weak.

The artillery men will be still better covered, and the embrasure less in view, at least from a certain distance, if you place at the top of it a few fascines, which are to be fastened to the parapet with pickets.—TRANSLATOR.

* When you wish to construct a platform, such as that first introduced by the author (vide Plate 40, supp. 1, fig.

SECT. IX.

If a work is constructed on a height not commanded by another, you have no occasion

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fig. 9 and 10,), you must begin by ramming the ground as smooth and level as can possibly be done all over the whole extent which the platform is to cover. Then, according to its intended breadth, three or five beams are used, which for procuring greater solidity are sunk into the ground and fastened with pickets driven close to them into the earth on both sides. The beam in the middle must be in the same direction of the centre-line of the embrasure; the others are placed on the right and left of it: the exterior surface of those beams, and the top of the pickets, are to be on the same horizontal plan, in order that the platform should not be lower on one side than on another.

Next the heurtor is to be placed, whose direction must be perpendicular to the vertical plan of the centre-line, so that if the embrasure is direct, it will be close to the foot of the parapet through its whole length. If, on the contrary, the embrasure should be oblique, it will only be close to the parapet at one end, and at some distance, on the side on which the centre-line inclines.

In order to determine this distance, the heurtor is to be laid, in all its length, against the foot of the parapet; and the middle, or centre of it, meet exactly with that of the interior opening of the embrasure: you then measure with a cord the distance from that of its extremities which is to be close to the parapet, to a picket which is planted vertically in the continuation of the centre-line, and nearly

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for embrasures, since your cannon may fire *en barbette*; in which case the platforms are

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at the extremity of the space allowed for the recoil of the cannon. You next double the cord at a length equal to that distance; you leave the first part of the cord between the fixed extremity of the heurtor and the picket, and stretch the other part until its extremity meets that extremity of the heurtor which is to diverge from the parapet: lastly, the heurtor is fixed in that situation with strong pickets, which are driven on both sides, and at both ends of it, and with earth thrown between the heurtor and the parapet.

I am well aware, that on account of the cannon which is generally used for the defence of field-works being short, the heurtor is not without inconveniences. It has that, for instance, of impeding a greater length of the pieces entering the embrasure, which is more particularly felt in proportion as the latter is more oblique; but as in this case, particularly, it fixes the direction of the fire in a parallel line with the face that is to be flanked, which is of essential consequence in an attack made at night, or in foggy weather, I shall always recommend it to be used at least for twelve pounders; besides, it protects the lining by preventing the carriage-wheels from running against it.

The heurtor being fastened by the means I have just indicated, boards of about one and a half, or two inches thick, are placed over the beams, the first close to the heurtor, the second close to the first, and so on successively. These boards are fastened to the beams, and fixed at the distance of the recoil, with three strong pickets, on a level with the plan of the platform. For farther security a

picket

raised proportionably, and this essential advantage gained, that you are able to give the guns

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picket may likewise be driven at each of their extremities.

The platform fig. 10 is preferable to that fig. 9, in so much that it facilitates the means of giving an oblique direction to the cannon; however, the mode of construction is the same, with this only difference, that in the platform fig. 9 the lateral beams are to be parallel with the centre one, whereas in that fig. 10, the lateral beams are placed in an oblique direction.

The beams in general are ten or twelve feet long, and six inches square, and the boards eight or ten feet long, and one foot wide, which determine the length and width of the platform. These dimensions, however, vary according to the size of the cannon, and to the recoil. It may be observed, that in the platform fig. 10 the boards the nearest to the parapet are the shortest, and that their length is increased in proportion as they are at a greater distance from it.

Lastly, when the embrasure is direct, it is advantageous to make the platform slightly incline towards the parapet, which not only lessens the recoil, but makes it more easy to run up the piece after loading. The fig. 11, Plate 40, (supp. 1st) represents the profile of such a platform, with a heurtor *x*.

Respecting the other platform (vide Plate 40, supp. 1, fig. 8,) mentioned by the author, and which is to be used only when no other is practicable, you must likewise begin to smooth and level the ground, and drive in the boards (which must be very strong), so that their exterior surface

and

any direction, without being confined by embrasures. But if the enemy have it in their power to erect counter-batteries on another height, embrasures then become absolutely necessary, that your cannon may not be so easily dismounted.

SECT. X.

If you have a numerous garrison, and a great many pieces of cannon to defend a work, you may derive great advantage from batteries erected particularly in the angles, and elevated higher than the other parts of the work: to this effect a rampart of earth is raised behind the parapet, above the ordinary level, (vide Plate 28, fig. 2,) to place the guns upon; and you have a better command of the surrounding country. The Plate will shew those ramps,

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and that of the ground be on a level. They are likewise fastened with pickets. Their distance from one another depends on the width of the track of the gun, and their length must be such, that the recoil should not occasion the wheels to run off. Between those boards, and farther backwards, two more are placed in the same manner for the trail of the carriage, and if the soil should be so soft as to create apprehension of its sinking, strong pickets must first be driven, and the boards fastened over them.—TRANSLATOR.

which

which are made for the purpose of the cannon being easily got up and down.

SECT. XI.

When the entrance of a work is covered by a traverse withinside, the parapet of this latter need not be so thick, nor the ditch so wide as those of the work; eight feet are sufficient for the thickness of the parapet, and the breadth of the ditch, six feet deep: in the mean time, if the traverse were not of the same height with the rest of the parapet, the garrison would be exposed in the rear. If there is a fleche before the entrance, the gorge must be closed with chevaux-de frise, and a communication made with the work.

SECT. XII.

The entrance of the work should also be secured with a strong barriere,* or two or three chevaux-de-frise, through which the troops may fire with small arms: the passage may likewise be filled up with a great number of logs of wood, ready to be set on fire, in case the enemy should attempt to force it. (Vide Plate 28, fig. 3.)

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* A kind of open gate, made of cross-bars seven feet long and six inches thick.—TRANSLATOR.

SECT.

SECT. XIII.

The beams to which the fraises are nailed are laid on the level ground, inside of the parapet, parallel to the exterior side, and about three feet distant from it. (Vide Plate 29, fig. 1, *a*.) Three feet and a half of the fraises remain in the body of the parapet, and the other four feet and a half stretch over the berm, inclining a little towards the ditch. In order to strengthen the whole, pieces of wood from nine to twelve feet long may likewise be laid along the exterior line of the parapet *b*, to which the fraises are nailed in a like manner as the first. All this must be done previously to the exterior side of the parapet being lined. However, when redoubts are fraised the exterior side is seldom lined.

SECT. XIV.

You may fortify the ditch either with a single or a double row of palisades. If you have but one single row the palisades must be nine feet long, planted perpendicularly in the centre of the ditch, in a narrow trench, dug two feet deep. (Vide Plate 29, fig. 2.) These are placed three inches asunder, and that they

may be more steady, you nail all along, within two feet of the point, either laths or split pieces of wood.

If a double row is used to fortify the ditch, the first, *a*, must be ten feet and a half long, planted in the bottom of the ditch, along the line which determines the interior talus. (Vide fig. 3.) They must incline forward about three feet from the perpendicular, planted three feet into the ground, and placed three inches asunder. Owing to their oblique position, they are not so steady, of course they must be supported by beams *b*, about twelve feet long, and six square inches thick, to which the palisades are nailed. The palisades of the second row *c* are only nine feet long, planted upright two feet into the ground, and along the line marking the exterior talus of the ditch. Within two feet of the point, laths are likewise nailed.

This method of palisading a work is much more advantageous than the former; the second row of palisades is of the greatest utility, so far, that if the enemy have resolution enough to pass the ditch, they, however, can never stand on the slope of the exterior talus; and therefore be less adequate

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to the task of cutting down the palisades. Great care accordingly should be taken to fix them so firmly, that they could not be removed without infinite labour, or occasioning great loss from the fire of the garrison. They must never extend above a foot higher than the ditch, in order that the enemy may not destroy them with their cannon before they expose themselves to the fire of the musketry; and they certainly would succeed in so doing if they enfiladed a whole row of those palisades.

SECT. XV.

Unless there be great abundance of wood, and time sufficient, two rows of palisades are seldom used; and, indeed, in general one single row is enough; provided care be taken to make them ten feet and a half, and to place them obliquely. This will even require both time and labour: accordingly, if one row be planted perpendicularly at the bottom of the ditch, along the line of the exterior talus, it will afford a very good defence.

SECT. XVI.

A ditch may be fortified still more effectually

by placing a row of good strong chevaux-de-frise all along the bottom, well fastened together with cramp-irons. (Vide Plate 29, fig. 4.) The centre beams of the chevaux-de-frise must be twelve feet long and six square inches thick, as mentioned above, but the fraises need not be above six feet; these must project equally on both sides, two rows resting on the ground, and the other two pointing upwards. If the garrison will but discharge their duty, they can hardly be forced with such a good defence: the enemy being reduced to fill up the ditch with fascines, which can never lie properly on account of the chevaux-de-frise; they must find the passage of the ditch nearly impracticable, neither can they attempt it without being exposed to sustain considerable loss.

SECT. XVII.

In former times it was customary to place a row of chevaux-de-frise round a redoubt on the plain ground, about six paces from the ditch, and fastened together with chains or cramp-irons; but the cannon being now more generally in use, the shot would soon demolish what would have taken up several days in constructing.

SECT.

SECT. XVIII.

When wood is near at hand, it is a much better method still to cut down large trees, and lay them in form of an abattis a few paces in front of the ditch. The branches of course must be well entangled into one another, presented towards the enemy, and the trunks next the work.

SECT. XIX.

Trous-de-loup dug round a redoubt, and very close to one another, may likewise oppose the approach of the enemy. It is known they are to be circular at top, about four feet and a half diameter, and pointed at bottom, like an inverted cone, and six feet deep. A stake six feet long, and made sharp at top, is fixed in their centre, and driven two feet into the ground. (Vide Plate 30. fig. 1.) Two or three rows of them are dug checquer-wise, at about six paces from the edge of the ditch, and in the following manner: two rows are placed exactly opposite to each other, the third row in the middle covers the intervals.

SECT. XX.

If there is time sufficient, and if the post is intended to hold for a considerable length of time, it is proper to erect within the work a guard-house, built of large beams and planks, to shelter the garrison from the inclemencies of the weather. It should be sunk two or three feet below the surface, that it may be less exposed; and to protect it against the enemy's grenades, joists are to be laid along the top, and to be covered with about two feet of earth. All round, and at three paces from the guard-house, a row of palisades must be planted, with space enough between them for the soldiers to fire through. Should the garrison be forced to quit the parapet, they may make a last effort behind this inclosure, which is accordingly closed up with a strong barriere made fast within-side.

SECT. XXI.

The banquette is made with the earth that is taken from the ditch; but if the redoubt is constructed on a height, the earth then must be taken from the interior part of the work, which is dug up half a foot or more for

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the purpose. Both time and trouble may be saved by giving less breadth and depth than above mentioned to the ditch, if the redoubt is constructed upon a very high hill, with defiles at the bottom of it, that render the access difficult. From the inside is taken the additional quantity of earth necessary for the proper dimensions of the parapet; and by such means the garrison are sooner put under cover the same as in a trench. In these cases a banquette is ■ dispensed with.—However, the preceding method is to be used only in stony heights, where there is not earth enough to form the parapet, unless it is scraped up from the interior surface.

SECT. XXII.

If a redoubt is commanded by a height within cannon-shot, that part of the parapet which faces the height must be so elevated as to cover entirely the troops who line the other parts, in order that they may not be seen either in reverse or in flank.* To procure earth

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* The author has omitted establishing a rule to determine the necessary height of the parapet to answer the purpose. That which I am going to give, though ever so

enough for the parapet it is necessary to encrease both the breadth and depth of the ditch. The banquette must also be raised proportionatly in this case, and, in order that the troops may easily get up to fire over the parapet, it should consist of at least two steps (vide Plate 30, fig. 2,), which of course will increase it breadth. In the mean time, if, notwithstanding the raising of the parapet, that part of the work which is opposed to the enemy should not effectually cover the men posted behind the other faces, then it becomes advisable to make traverses as an additional security.

SECT. XXIII.

When a work is only exposed to the fire of musketry from a neighbouring height, a single row of small gabions, filled with earth, must be placed along the top of the parapet on that side. These, as mentioned before, must be one

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simple, will prove satisfactory in the practice. Let a man place himself at that distance behind the parapet at which the garrison is to be covered; let the parapet then be raised to such a height that the aforesaid man will not be able to discover another man posted on the eminence which commands the work: the enemy then can neither see nor hit the former.—TRANSLATOR.

foot

foot high, twelve inches diameter at top, and only ten at bottom, that the men may easily fire between them. (Vide Plate 30, fig. 3.)

SECT. XXIV.

If all the earth that is dug out of the ditch cannot be made use of, it should be scattered about without-side of the work; care must be taken not to leave it in heaps, which might cover the approach of the enemy, who should be entirely discovered: sometimes the earth remaining is used to make a glacis, which encreases the depth of the ditch, and which the enemy cannot ascend without being more exposed to the fire from the intrenchment.

SECT. XXV.

Care must likewise be taken to preserve the powder and cartridges from getting damp, as well as from being set on fire by the enemy's grenades. To gain this end, holes by way of magazines are dug within the work, the sides of which are lined with planks to keep the earth from tumbling in; these holes must be covered with strong pieces of wood.

SECT.

SECT. XXVI.

In order to construct a redoubt, or any other work with expedition, there should be exactly double the number of workmen employed in the construction of it as there are soldiers appointed for its defence. A work, therefore, intended to contain two hundred men, requires four hundred workmen. As soon as it is traced, one half of the men are set to work, and the rest are employed during the three first hours in making the necessary materials, such as fascines, pickets, palisades, gabions, &c. which they lay in several parcels or heaps, and afterwards make a proper application of. These last two hundred men are to be divided into two parties, that relieve each other every two hours. An hour's rest is allowed to both previously to the relieving the two hundred workmen employed in throwing up the earth, that they may be able to work with better spirits. The two hundred who are relieved are likewise to rest for an hour, after which they are divided into two parties, to make fascines, &c. as the first, and relieve each other regularly in the same manner. In order to keep the workmen to their duty, a proper number of officers

and

and of non-commissioned officers must be appointed to every thirty men.

SECT. XXVII.

One half of the workmen are supplied with pick-axes, one fourth with spades, and the other fourth with hatchets; which implies that, if one hundred men are at work fifty must have pick-axes, twenty-five spades, and the other twenty-five hatchets. It would be very advisable to have every hundred workmen attended by ten men carrying axes, and who understood something of a carpenter's business.

SECT. XXVIII.

It is proper that the different kinds of materials should be laid regularly in heaps, and by themselves, as aforesaid, that they may be near at hand when wanted: for if they were scattered about here and there, they would be in the way of the workmen. Accordingly the palisades and fraises, with the quantity of fascines and pickets that are wanted to line the outside of the parapet, must be laid on the edge of the ditch; and the remainder of the fascines and pickets are taken within the work to line the banquette and the inside of the parapet.

CHAPTER V.

Of fortifying Churches, Church-yards, Castles, or any other Stone or Brick Buildings, with the adjacent Out-houses.

AS there may occur an infinite number of reasons for fortifying posts of this kind, i would only take up time to enumerate them, we shall therefore be satisfied with observing that, in general, it is not possible to take too many precautions against an enemy; that the preservation of such posts, besides its being of the highest importance for the good of the service, may at the same time procure to an offi cer the means of acquiring reputation, and entitle him to claim a recompense for having made both a good disposition and a vigorous resistance. Neither can an officer take too much pains to become perfectly well acquainted with every particular of this branch of his profession: nay, he should go farther, and contrive to imagine new obstacles and new difficulties, to oppose the enemy when circumstances will require. These posts vary to such a degree, either on account of the buildings, of the situation or lying of the ground all around them,

that

that it would be a vain attempt to pretend establishing rules for every particular case: for what may be extremely proper in one case, may prove very dangerous if practised in another. In the first place, the strength of the detachment, and the number of workmen should be known; then, whether the materials, without which nothing can be done, are provided or not, or if wanting, when they may be procured: finally, how long it will take to fortify the post; which last circumstance is of the highest importance; for if, from the situation of affairs, it is likely that the enemy will advance immediately, no other precautions should be taken but such as are absolutely necessary; those arrangements which would take up more time, and occasion much greater trouble, must be deferred till another opportunity. If neither materials nor workmen are wanted, and that there is time sufficient, the following rules ought to be observed.

SECT. I.

Let us suppose that a church-yard is to be put in a proper state of defence: you must begin by examining carefully the nature of its situation, and if there should be any stone or

brick

brick buildings within musket shot, or if it were commanded by any neighbouring height, the best dispositions would be of no avail, and the post must always be bad.

In the second place, you must consider whether there are troops sufficient to defend it: if there are not, no fortifications whatever can prevent the enemy from making themselves masters of it in a very short time; so that whether the post is but weakly or not at all defended, makes no difference; under such circumstances, therefore, the only thing an officer has to do, is to confine himself to fortifying the church.

SECT. II.

However, with regard to the church-yard, the first care must be to barricade without exception all the roads and avenues that lead to it with carts full of dung, two wheels whereof are taken down, or by cutting down large trees, which are left entire in the roads. The access may occasionally be defended by trous-de-loup, chevaux-de-frise, &c. The small narrow paths may be blocked up with harrows laid with their points upwards, and well fastened to the ground with strong stakes, or with logs of

wood

wood piled up, and placed in such a manner that it would be rather difficult to remove them. Large boughs of trees intangled into one another may likewise be adopted. Deep ditches may also be cut across. In short, every thing that can impede the approach of the enemy, by encumbering the passage, must be used. It is to be observed, however, that all these obstacles must be within musket-shot of the church-yard, that they may be defended by the fire of small arms; for, if not, the enemy would be able to surmount and remove them without the least danger or resistance.

SECT. III.

The gates, either large or small, must be powerfully barricaded with beams, or logs of wood, through which loop-holes are pierced about seven or eight feet from the ground. This height is adopted with a view of preventing the assailants from making use of them against the garrison. The soldiers who defend the gates stand within-side on scaffolds, similar to those used by masons, and which are erected behind. Loop-holes are also to be made at the bottom of the gate, almost on a level with the ground: a ditch three feet and

a half

a half deep must also be dug just behind, and the earth be scattered towards the rear. Men are posted in the ditch, to fire through the lower loop-holes, which is of essential service to prevent the enemy from approaching the gate, and perhaps from setting fire to it, which they might easily effect by stooping, and running up. When wood happens to be scarce, earth may be thrown up against the gate; but in that case the lower loop-holes cannot be of any service.

SECT. IV.

When the wall of the church-yard happens to be very high, and that plenty of wood can be got, a scaffolding should be erected all along the inside, or at least at certain distances; this the soldiers mount by means of planks, with laths nailed across, in form of a ladder. Loop-holes about eight inches long are pierced through the wall, seven feet from the ground: the garrison having such a command of the enemy when they make their attack, must necessarily incommode them much. Loop-holes may likewise be pierced at the bottom of the wall, and a ditch made behind it, as practised behind the gates, and which entirely endangers the

the enemy, even when at a few paces from the church-yard.*

SECT. V.

Should the wall happen to be very high, and no wood for scaffolding to be procured, the upper part of it should be broken down, and the rubbish will serve to make a banquette of sufficient height: whereas, if the wall is very low, a ditch must be dug behind it, sufficiently deep to cover the garrison breast-high.

SECT. VI.

Very near the bottom of the wall, on the outside, a ditch is made, but in such a manner as not to affect the foundation; it should be about twelve feet wide and four deep, and

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* Where several rows of loop-holes are made, these should not be placed directly over one another, but so disposed that those of one row may be in the intervals of those of the other, by which means the fire will extend more from the whole front of the wall, which it is essential not to render too weak by dint of multiplying the loop-holes. Particular care must also be taken to make them especially in those parts where the wall projects, and at the angles, which, the same as in redoubts, are the weakest parts.—TRANSLATOR.

pointed at bottom, that the enemy may have no footing. The earth that is dug up must be scattered about, but no heaps left which might conceal the approach of the enemy. The post may be still further strengthened, if there are trees around the church-yard, or near at hand, by laying them entire along the bottom of the pointed ditch.

SECT. VII.

Every thatched house in the neighbourhood must instantly be uncovered, and the straw destroyed. It is likewise advisable to unroof such as are covered with tiles, to prevent the enemy taking possession of them, and firing from the garrets that overlook the church-yard, which of course would soon render it untenable. The walls of every house within musket-shot should also be demolished, that the enemy may not conceal themselves behind them, and annoy the garrison by their fire. In short, on whatever side the enemy may make their approach, every possible means must be used to discover them. All the trees and hedges of the neighbouring gardens must accordingly be cut down, and thrown, as mentioned above, into the pointed ditch on the outside of the wall;

wall: on that side where it seems more probable that the attack will be made, the obstacles must be encreased, such as fougasses, or trous-de-loup, if materials can be procured.*

SECT. VIII.

A garrison that uses all these precautions, and are steady in the discharge of their duty, will not be forced easily without cannon: but if the enemy have artillery with them, and make a breach in the wall with the design of attempting an assault, it becomes necessary then to endeavour to defend the breach (especially if the post must be held to the last), by filling it with logs of wood, which some of the volunteers set on fire. All the trees in the church-yard must be cut down, and thrown, branches and all, into the breach. All these precautions will embarrass the enemy to such a degree, that, after wasting their ammunition to no purpose, they will be obliged to recommence a new attack. However, if they persist in gaining their aim, the wall must be

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* This defence, by means of fougasses and trous-de-loup, is truly advantageous, and must be adopted when practicable.—TRANSLATOR.

finally abandoned, but not till the very last extremity, and the garrison make their retreat to the church, where it is supposed that every individual has a previous knowledge of his post.

SECT. IX.

When you want to fortify a church, the first thing you have to do is to secure the gates, so that the enemy be not able to force them, which may be done by means of a work formed of palisades, and that is called a tambour. (Vide Plate 31, fig. 1, *a*.) For the construction of this tambour you must procure pieces of wood ten feet long and six square inches thick, which you plant close together, and drive three feet into the ground, in such a manner that when compleated it has the appearance of a square redoubt cut in two. On each flank is to be left an opening *a*, for the troops to have a free passage to the church when they abandon the wall. Within the tambour, at six feet from the ground, you pierce loop holes three feet asunder, about eight inches long, two wide within, and six without. You next erect a scaffolding two feet high within-side, for the garrison to stand upon; or, for it is no matter which, you may raise a banquette of a similar height, and made of earth

taken

taken from the inside of the tambour. Immediately above this scaffold or banquette, in the intervals of the upper row, you pierce another row of loop-holes, by which means the three sides of the tambour have each a double row of loop-holes. (Vide fig. 2.)

If it is not possible to procure wood of the above mentioned thickness, thinner pieces may be used, but in this latter case it is necessary to nail planks within-side, both to make good the deficiency, and to prevent the enemy's shot coming through: you must begin to line it from the bottom. Next a pointed ditch is to be made outside, and at two paces distance from the tambour, and the earth dug up is scattered all around. It is a very good precaution, and of very great service, to cover the top of the tambour, by laying beams or joists horizontally over it, supported by others which stand perpendicular, to protect the garrison against the enemy's grenades. Planks are to be laid on the joists, and earth taken from the ditch, and about two feet thick, above them. These tambours are of essential service, both to defend the entrance of the church, and to furnish a cross-fire for the right and left of the building; but they must be occupied by a sufficient

number of troops, before the wall of the church-yard is abandoned, that the retreat of the rest towards the church may be properly covered.

In order to defend the wall by a cross-fire, tambours may likewise be constructed before the gates of the church-yard, with this difference only, that these have oblique flanks without any opening. (Vide Plate 32.)

SECT. X.

At two feet from the ground an opening of about three feet square is cut in the church gate, with room for one man only to pass at a time. This must be covered with a small door made of planks, and bolted within-side, which will be the only passage into the church, the other parts of the gate being strongly barricaded: so that admitting that the enemy had rendered themselves masters of the tambour, they would not dare to approach the gate, which is pierced with loop-holes.

SECT. XI.

If the windows of the church are so high as to render it impossible for the enemy to fire in upon the garrison, a scaffolding must then be

constructed

constructed in the inside, from upon which the latter fire into the church-yard; but if they should be so low, that the enemy were able to see and to fire into the church, they must instantly be closed up with beams and planks to about eight feet from the ground, and a scaffolding of a proper height be erected behind for the garrison to stand upon.

SECT. XII.

If the walls of the church are not too thick, loop-holes must be pierced all round into them: the galleries, if there should be any, will answer the same purpose as a scaffolding; the loop-holes, of course, must be opened accordingly, that is, according to the height of the galleries. Another row of loop-holes, within seven feet of the ground, should also be pierced: the seats and pews of the church may be used by way of banquette; but if the walls should happen to be too thick, that part which stands between the pillars, being generally thinner than the rest, the loop-holes are to be pierced there.

We have given above the common proportions of loop-holes, that is, eight inches long, two wide within, and six without.

SECT. XIII.

In all these kind of works the chief aim must be to obtain a cross-fire. Churches in general are built in form of a cross, this advantage therefore is gained at once, since there is a cross-fire from the loop-holes: yet it may happen that the form of the principal building is not such, in which case the above advantage must be sought for by making loop-holes in the porches, vestry, or other projecting parts of the church: if even these should not answer the purpose, tambours then must be constructed at each side.

SECT. XIV.

Soldiers should always be posted in the upper part of the church, that they may discover the enemy at a distance, and fire upon them: the windows of the steeple ought at the same time to be barricaded, and loop-holes made; even the pavement of the church ought to be lifted up, and the stones or bricks carried to the top of the wall, in order to gall the enemy if they would attempt to approach too near.

SECT. XV.

For fear the enemy should attempt to set fire to the church, it is proper to provide hogsheads and tubs full of water, to be able to stop the conflagration.*

SECT. XVI.

If a castle, country seat, or any other building of the kind, with the adjoining out-houses, such as stables, barns, brewhouses, &c. are to be fortified, it is necessary to know first the number of troops that are intended for the defence. If these are a considerable force, the principal building then, together with the adjoining out-houses, and the wall that surrounds them, must be put in a state of defence; but if there are only a few men, the castle or country seat alone must be fortified.

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* The different methods which the author proposes for the defence of a church-yard and of a church are equally good; but they require materials and workmen in abundance, besides sufficient time. Other and more proper measures might therefore be used. The reader may see in Section 29 of what little service posts of this kind generally are.—TRANSLATOR.

SECT. XVII.

After having pierced loop-holes in the wall round the inner yard, banquettes of earth and of a proper height must be made for the garrison to stand upon, the same as mentioned above, behind the walls of a church-yard. In this case the troops are disposed in such a manner, that you have a reserve left in the inner-yard to assist wherever they may be wanted.

SECT. XVIII.

The chief care to be taken in fortifying such posts is to procure a cross-fire, which is very easy when the walls flank each other, as loop-holes only are wanted; but should this not be the case, fleches or tambours must then be constructed with oblique flanks, particularly to defend the entrances. The above mentioned method must be used, to barricade all the roads by which the enemy can approach it. The barns, stables, and other out-houses being of masonry, loop-holes must be made in the walls, on the side facing the country, likewise on that next to the inner-yard, to be able to fire upon the enemy, when either of the passages are forced. Every obstacle that can be imagined,

gined, should be made use of, if there is time enough to spare; and if there is powder in abundance, fougasses even should be disposed before the weakest parts, in order to blow up the enemy should they attempt to make an assault.

All combustible matters, roofs of thatched houses, dry branches, wood, &c. ought to be immediately collected and burnt, to be guarded against fire.

SECT. XIX.

So long as there be wood enough and other materials to fill up the breach, the wall of the inner-yard must be defended, although the enemy were to bring cannon to batter it in breach; but when no longer defensible, either because it is too large, or that the enemy are preparing to storm it with a force superior to the garrison, and which they despair of being able to resist, it is proper then to abandon the out-houses and inner-yard, and to retreat to the castle, where every individual is supposed to know beforehand the post that he is to occupy. In this critical juncture, care should be taken to have troops both in the first story,

and

and garrets, to cover the retreat of those who lined the walls.

SECT. XX.

You must always observe, when you fortify castles of this kind, that a wall of brick is preferable to one of stone, as a ball easily pierces the former, and leaves but a small hole; whereas large openings are made in the latter, and great mischief ensues from the splinters flying about.

SECT. XXI.

In order not to be exposed to fire, you must lay about two feet thick of dung over the floors of the garrets, and provide large tubs filled with water, for fear such an accident should happen. Notwithstanding the gate, and every other entrance to the house should be strongly barricaded, yet you must so contrive as to be able to open them easily if circumstances required it. Loop-holes of course are pierced through, and troops posted behind them.

SECT. XXII.

The windows of the ground floor must be closed with planks and beams eight feet from the ground, or with bricks, which is more expedi-

expeditious, leaving, however, openings to fire through. The wood and bricks of the partition walls may be used, in case no other can be procured. The loop-holes that are made in the windows, must be about seven feet from the ground, and three feet asunder. A scaffolding should likewise be erected, if there is proper timber, if not, the chairs, &c. &c. may be made use of.

SECT. XXIII.

The boards of the floor may be taken up, if found requisite, and loop-holes pierced in the wall, one foot above the level of the ground; but in this case, a ditch six feet wide and three and a half deep must be dug along the inside, at one foot and a half distance from the wall, and where the garrison is placed. A ditch, pointed at bottom, may also be dug on the outside, quite along the foot of the wall to oppose the enemy's approach. There should be a double or even a triple row of loop-holes at the corners or angles of the house, which are always the weakest parts. The reserve are generally posted in the hall or vestibule.

SECT. XXIV.

There must be loop-holes also in the other stories;

stories; but one row will be enough, if at about three feet and a half from the floor. In case there should be any towers or other projecting parts, which might furnish a cross-fire, they should be pierced with three rows of loop-holes; a proper scaffolding should likewise be erected, by which means the garrison would be enabled to make a better defence. If the tiles of the roof be removed here and there, you may fire upon the enemy; and if there are any galleries communicating from one part of the building to another, they may be rendered useful, nay of great service, if you line the balustrade with sacks full of earth, and place troops behind them.

SECT. XXV.

If the building should have an extensive front, and only one stair-case leading to the second floor, let the ceiling of the ground and first floor be opened at each end, to procure communications between the two floors. In case there should not be time sufficient to construct stairs, ladders will be used. By this means, the troops in the different stories will be the better able to assist each other, and those in the first floor may retreat to the second, when forced to give up their post.

SECT.

SECT. XXVI.

If a post is of such consequence as to require being defended to the last extremity, whilst the enemy are bringing up their artillery, and as soon as it is perceived where they intend to make a breach, previous to their rendering it practicable, a good quantity of large beams, planks, &c. &c. must be collected, which serve to construct a retrenchment or small work in form of a re-entering angle, behind the part threatened, where troops are posted to receive the enemy when they give the assault.

SECT. XXVII.

Notwithstanding all these precautions, if the enemy should make themselves masters of the first story, those who defended it will retire to the second, where they may still make some resistance, by defending the stair-case, opening the floor and firing down from different parts. However, this resistance can prove but of a short duration, for when the enemy are masters of the under part of the building, they may easily set fire to it, if the garrison refuse to capitulate.

The Plate 33, contains an exact plan of a post of the kind, and admitting that all the materials

materials requisite are at hand, we shall proceed to indicate in what manner it is to be fortified.

The gate-way *a* between the barns and brew-house, is covered by a small work of earth *b*, the parapet of which is twelve feet thick; in front fougasses *c* are made, this place, on account of the rising ground, being the most likely for the enemy to make an attack. Now if the entrance between the barns and the stables *d*, is covered with a tambour *e*, the two sides will be furnished with a cross-fire. The ground before this last work being low, trous-de-loup *f* are dug in front of it. All the doors *g* of the barns must be strongly barricaded, and covered on the outside with ditches *h*, pointed at bottom. All the hedges *l*, which inclose the kitchen garden *i*, must be cut down, that the view be quite unconfined. Loop-holes are made in the wall *m*, in which there is a door that opens into the garden, scaffolding being erected behind the wall, and the door well barricaded. To defend the fruit garden *n*, inclosed next the court yard with a wall *o*, you must make a row of loop-holes, throw up earth in form of a breast-work *q* against the back-part, which is only surrounded by a quickset

hedge

hedge *p*, and post troops there. These lines are flanked by the garden house *r*, the keeper's house, and the work *b*. The door *s* is barricaded, and loop-holes pierced in each side of the wall. There is no occasion to cover this with a fleche or tambour, as it can only be approached by a narrow dyke or causeway, laid over the marshy ground, which may be cut in different places *t*, and the sluice shut; so that the brook *u*, will soon overflow the meadows behind the fruit garden. All the out-houses, as stables, barns, &c. must be supplied with loop-holes, and scaffolding erected within-side, as mentioned above.

The chateau, which we will suppose to have two wings, is enclosed in front by a wall *x*, which also is supplied with loop-holes. In order to protect the retreat of the garrison, in case they should be obliged to abandon the wall, and out-houses, &c. the great gate of the dungeon is covered by a tambour *z*. However, it is absolutely requisite to cover this work with planks and earth, from this reason; as the enemy will occupy the keeper's house and stables, the very moment they are evacuated, it would be impossible for the troops otherwise

to maintain themselves there, against the fire from the upper parts of those buildings.

The three entrances of the house A, B, C, must be barricaded, and indeed the post must be so strengthened by piercing loop-holes in every convenient part, that a cross-fire may be obtained on all sides. It is likewise requisite, not to forget that all the trees and hedges of the park D D, are to be destroyed to prevent the enemy advancing under cover.

SECT. XXVIII.

Upon all similar occasions, it is very necessary to be as sparing as possible of powder, and never to fire upon the enemy till it can be done with effect; for the ammunition is no sooner expended, than the garrison must submit to whatever terms the assailants will please to dictate. The commanding officer of the detachment ought likewise to take previous care that his men be provided with provisions for some days, in order that he be not reduced by famine to accept of dishonourable terms.

SECT. XXIX.

All such posts are never intended to hold out a regular siege; as indeed when the enemy bring

bring artillery with them, the affair in general is soon at an end. Nevertheless, an officer may find himself in two situations, when he must not even think of demanding a capitulation; but on the contrary when he must defend himself to the very last, and at all events. First, when positively ordered to maintain the post, cost what it will; or when there is a probability of his receiving a speedy succour. In both these cases a man of honour will never trouble himself about the consequences, but continue to defend his post to the last extremity, and take his chance.*

CHAPTER VI.

Scheme for fortifying a Village.

THERE are several reasons for fortifying villages; when they are not too far from your

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* The author himself allows, that those posts are only tenable when artillery is not used to attack them. But since the time of his writing, all armies are supplied with such a quantity of cannon, that very few detachments even march without. Those posts, therefore, must never be used but in case of absolute necessity, or when they are defended with artillery.—TRANSLATOR.

camp, they keep the enemy's irregulars at a distance; and upon a day of battle serve to cover the advanced posts, and sometimes even one of the wings of the army. When the troops are in cantonment, or in winter quarters, villages that are put in a state of defence, are of use to prevent surprises, particularly those which by their situation, as being nearest the enemy, are most exposed. From whatever motive you propose fortifying them, always observe the following rules.

SECT. I.

The first thing to be done, is to examine and reconnoitre the country all around, in order to ascertain whether the enemy can penetrate unperceived, under cover of any wood, &c. whether or not the village be commanded by heights; likewise, whether the communication to it be easy or difficult; whether a brook runs either through it, or on one side only, and what is the nature of the banks; whether the enemy would be incommoded by making it overflow; lastly, by what means the garrison may be most easily relieved, and in case a retreat might be necessary, in what manner it may be effected with safety. All these are

essential

essential points, which ought to be duly considered beforehand, in order to take every advantage that can result from a perfect knowledge of the ground. As, for instance, it will frequently happen that a deep and rugged ravine, a simple rivulet with steep banks of no easy access, an inundation which may be formed, an impassable morass, a flat ground intersected with ditches, and many other advantages, will cover a post much more effectually than any method whatever in the power of art.

SECT. II.

If the houses should happen to be built in stone or brick, with tiled roofs, there can be but little apprehension from fire, and then the outermost ones, and in general those next the country, should be loop-holed; especially where the roads enter. Whereas, if the houses are only built of wood with thatched roofs, it would be in vain to attempt converting them into use, and in this case works of earth must be had recourse to. In the construction of these the obtaining of a cross-fire is the chief object to be regarded; as also that they are at such a distance from the houses, that should these

accidentally catch fire, the heat would not oblige the troops to abandon the works.

SECT. III.

When the village stands in a plain, in front of an army, or opposite to one of the wings, and that, in case of an action, it is intended as a post which is to be maintained, it becomes requisite to level all the ground between that village and the army, to fill up all the ditches and hollow ways, or at least to make good communications across them. All the hedges and brush wood of course must be cut down, and every obstacle removed that might prevent the troops being easily and expeditiously sustained from the line. On the contrary, the enemy's approach must be rendered as difficult as possible, which may be effected by cutting down within two feet of the ground, on that side of the village which lies next to them, all such hedges, thickets, woods, and even single trees, which might serve to conceal their march, in order that they may be seen at a distance, and exposed to the fire of the artillery from the works as soon as they appear. If time will allow, deep trenches should be cut across the roads by which the enemy is obliged to pass,

and

and the trees, if any planted along the sides, cut down and thrown into them. To prevent the enemy's advancing in line, and in close order, trous-de-loup may also be dug, so that one may finally be almost assured that then every attempt will prove useless.

SECT. IV.

Such intrenchments as are intended to fortify villages, can never be entirely regular; it is impossible, therefore, to lay down rules respecting their figure, which is determined by the nature of the ground. It is the ground indeed which indicates the proper situation of each line, to those officers who know how to form a right judgment of it.* All that can be said on the subject accordingly, is to recommend a cross-fire upon every occasion, if it can possibly be procured. When there are quick-set hedges, they must be cut off breast high, with a ditch dug behind them, and an intrench-

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* From what the author says, it becomes obvious, how essential it is for an officer to be well acquainted with the art of reconnoitring the ground, in order to know how to take every advantage, and to avoid every inconvenience it may offer.—TRANSLATOR.

ment erected as usual, beyond the ditch; which obstacle on the brink of a ditch is nearly insurmountable. If there should be any hollow-ways parallel with the post, and at a proper distance, banquettes may be raised inside of them. The man of genius and application, after a very little experience, will readily seize every advantage of this kind, which cannot escape his observation.

But if the situation should be such, as to afford no natural advantages of this kind, or if the gardens are of no consequence, or too near the houses, (which might be set on fire by the enemy,) the intrenchment then must be advanced something more. This must be composed of large fleches, with a parapet twelve feet thick, constructed at a proper distance; which being joined by lines, and well provided with artillery, will render the post very respectable.* If there is time enough, the attack

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* These fleches are called *redans*, and the whole intrenchment, *an intrenchment with redans*. The redans must be sufficiently capacious, easily to contain 250 or even 300 men, and at least two pieces of cannon; the greatest distance asunder they are to be placed, must not exceed the reach of musket-shot, in order that each redan be flanked by the neighbouring ones. The angle included by the faces,

should

may be made still more difficult, by adding to the weakest part palisades, chevaux-de-frise, abbatis, trous-de-loup, fougasses, &c. &c.

If possible, the church and church-yard

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should not be less than nearly 70 degrees, for although the flank-defence of the curtain and neighbouring redans is better the more acute that angle is, yet if it were so to a certain degree, the interior capacity of the redans would be too narrow, and they would contain neither a garrison or artillery sufficient for their defence.

With regard to the manner of tracing an intrenchment of the above description, the following method is to be observed.

In a right line, set off 120 toises from A to B, from B to C, &c. (Vide Plate 41, supp. 2, fig. 1,) and from those points, draw the demi-gorges Aa, Ab, Bc, Bd, &c. each equal to 15 toises. Next, from the same points A, B, &c. draw the perpendiculars Ag, Bh, &c. each equal to 22 toises, and by their extremities *g*, *h*, &c. and those of the demi-gorges *a*, *b*, *c*, *d*, &c. draw the lines *ag*, *bg*, *ch*, *dh*, &c. for the faces of the redans, then *agb*, *chd*, *eif*, will represent three redans, and *bc*, *de*, the curtains between them.

Intrenchments with redans, such as the author proposes, have great imperfections, which I shall describe more minutely in my subsequent supplementary chapter, where I intend to introduce a much better method of constructing them; I shall also treat of the other kinds of intrenchments which Gaudi has omitted, and which, according to the ground and circumstances, are equally applicable to the fortifying a village as a camp.—TRANSLATOR.

should likewise be fortified; for the more obstacles the enemy shall have to encounter, the greater must be the hopes of his being repulsed. The army being supposed to be near, there is little danger of not being properly supported in the day of battle, so that one cannot think they will do too much. Notwithstanding the flanks of the intrenchments must be well covered, nevertheless, it is necessary the rear should be entirely open; for if the enemy, by sacrificing a number of men, should render themselves masters of the post, there might be great difficulty in dislodging them, if the line was carried quite round, and that they were determined to make an obstinate defence.

All the hedges between the village and the army must be cut down, as mentioned above, in order that any reinforcement may have easy access, and that if the enemy should attempt to advance, they may never be able to conceal their approach. The annexed plate, (vide Plate 34) fully illustrates whatever has been mentioned above. The village is seen to be situated in the plain, at about six hundred paces distance from, and in front of the army *a*. The front of the intrenchment is composed of three fleches *b*, *c*, *d*, joined by lines. In front

front of the works which cover the left flank *e*, trous-de-loup *f* are dug. The dyke *g*, which crosses the morassy ground *h*, is cut in several places *i*, and the wood *l* is destroyed, that the enemy may not approach unperceived. The right flank, where the ground is even, being the most exposed to an attack, trees, in form of an abbatis *n*, are laid within musket-shot. The lines are thrown up, as much as possible, behind the quickset hedges *o*, that inclose the gardens; it is necessary, however, to advance them in *p*, and to keep clear of those hedges for fear of being too near the houses, in case they should catch fire. In the rear of the village, all the hedges, trees, &c. are totally destroyed, and every thing laid quite open, for the greater facility of the communication with the army.

When villages are so distant from the camp, that the enemy may render themselves masters of them before they can be supported, the method of fortifying them is entirely different; for then the intrenchment must be made quite around them; however, if, on the contrary, such a post should be adjoining to one of the wings of the camp, the flank then must be chiefly attended to and properly covered, the works carried farther on and strongly defended,

so

so that the enemy may not be able to turn them.

SECT. V.

When a village is chosen to be one of the quarters of cantonment of an army, another method still is made use of to fortify it, as in that case there cannot be so many men to defend it. If per chance there should be a sufficient number, they must then intrench themselves in the manner above-mentioned, and cover their rear with fleches joined by lines, the same as they have in front.

If, on the other hand, the garrison should not be sufficient in number to defend extensive works, what are absolutely necessary, and such as they are able to man, must be only attempted. Small works or strong barricades may do to cover the entrances; here and there fleches should also be thrown, and the fences of the gardens may serve by way of communications.

Much less trouble is required to fortify a village when situated upon a height, for then the natural advantages alone render the post respectable; besides, many things may be omitted, which are indispensable when it lies in a plain.

SECT.

SECT. VI.

If the garrison should be too weak, that is, if its strength bears no proportion with the extent of the village, part of the latter only must be fortified, and a line thrown up to separate it from the rest; sometimes even it is necessary to set fire to the houses that cannot be included, in order to prevent the enemy from establishing themselves in that quarter, and advancing under cover against that part which is intrenched.*

SECT. VII.

Should the garrison be even too weak to defend a part of the village, they should at least endeavour to fortify the church, church-yard, or manor, if there is such convenient for the purpose. Upon the first alarm they instantly repair to their post, after having taken proper

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* An officer previous to his taking such a step, must carefully investigate the situation of things, and not act, unless it is become indispensably necessary; for besides the injury which the inhabitants will be exposed to, he would diminish the resource of a cantonment, and deprive himself of the facility of lodging other troops, if wanted, and if it became useful to reinforce the post.—TRANSLATOR.

precautions not to be cut off by the enemy. There is a double necessity for so do ng in long straggling villages, which are oftentimes so very open, that even cavalry may pass wherever they like. Every common road and avenue must, therefore, not only be rendered impassable, but the hedges must be thoroughly repaired, and the gaps and openings closed up, by means of strong stakes, and by nailing poles, or long pieces of wood across. These measures will most effectually prevent any sudden surprise from the cavalry, which alone is to be apprehended; as, unless the garrison are totally off their guard, the infantry would find it difficult to come upon them unawares, and prevent their having time sufficient to gain their post. When an attack is expected, the most prudent measure is to keep the men in their quarters in the day, and assembled during the night, either in the intrenched posts, or at least in the houses most contiguous to it, with strict orders not to undress.

SECT. VIII.

There are villages which it is absolutely impossible to defend, on account of the houses being scattered about in long narrow vales, surrounded

surrounded with high mountains and woods, or gorges and hollow ways, through which the enemy may approach unperceived. The best disposition in the world would answer no purpose at all, as the post can never be defended. All that can be done in such a case is not to quarter the troops in those parts that are nearest the enemy *a*, (vide Plate 35), but in those most retired *b*, which are to be separated from the rest of the village by an intrenchment of earth *c*, and by means of barricading every passage and avenue. If, near the village, there should happen to be a rising ground not commanded by any other height, a redoubt *d* may be constructed there, in which only the cannon and a small guard are constantly to remain. In case of an alarm, this post will be the place of rendezvous for the whole garrison, which, for that reason, are to be regularly assembled every night in the houses contiguous to the redoubt, especially when threatened with an attack.

A communication *e*, four feet wide, is made with palisades planted on each side, which run from the spot where the men assemble in the evening, to the redoubt, in order that the troops who quarter in the village may gain the

redoubt

redoubt with safety. The palisades must be far enough asunder to allow the men firing between them. When the communication is very long, a place of arms *f*, must be made about the middle of it, that a cross-fire may be obtained.

SECT. IX.

It must be allowed that one cannot be very easy in such a post; however, it is absolutely necessary to know how to make the most of it. In general, an officer must determine what defence he is to make, according to the orders he has received, but, if left entirely to himself, circumstances should regulate his conduct. When the village is only occupied with a view merely of giving notice of what may happen, to the other quarters more retired; or, if a few troops only are there, to cover the advanced posts of light troops against any small detachments of the enemy; the commanding officer then will be very reprehensible, if, without expecting any succour, he should attempt to defend himself to the last extremity, against a whole corps who had entirely surrounded him, and thus sacrifice his men to no purpose. It is incumbent upon him, however, carefully to examine the real strength of any

any body of troops that may be sent against him, without listening only to the reports of some deserters, or of a dispersed patrole. He must, himself, see and examine every thing. But if, on the contrary, there are quarters of cantonment near at hand, from whence he may reasonably expect relief, he ought to maintain his post to the very last man, and risk the whole to gain the whole. He must behave in the same manner, if his post is intended to defend a defile, or any other pass, likewise to stop the enemy till others, who are farther back, have time to assemble. In this present case, an officer must never suppose the enemy to be too strong, nor his own post too weak.*

CHAP. VII.

Different Kinds of Intrenchments.

(SUPPLEMENT.)

SECT. I.

I HAVE said in a note in the preceding chapter, page 153, that I would shew the im-

* The author ought to have added, that the commandant must inform, if possible, the commanding officers of those

perfections of the *intrenchments with redans*, constructed according to the method recommended by the author, and introduce a better one. This I shall explain before I treat of the different intrenchments which he has not mentioned.

Intrenchments with redans, such as proposed by Gaudi, have indeed a flank defence, and even a cross fire in front of each curtain; but, if it be recollected, as we have mentioned before, that the soldiers almost generally fire directly forward without taking their aim, and if attention be paid to the Plate 41, (supp. 2, fig. 1,) which represents an intrenchment with redans, of that kind, the lines of fire of which, are drawn in conformity with that usual manner of firing, it will be observed, that in consequence of the necessary oblique direction of the faces of the redans, which I have accounted for, there is a considerable space of ground in front of each salient-angle, which is not battered by any fire, neither is the ditch

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different posts, of his own situation, to demand from them proper succour, and to let them know on what point he will direct his retreat, if compelled to retire.—TRANSLATOR.

sufficiently

sufficiently defended. It will likewise be found that in front of each curtain, there is a very extensive triangular surface, which is only battered by the direct fire from the curtain; in addition to this, as each redan is to be flanked by the neighbouring ones, they must not be at a greater distance from one another than one hundred and twenty toises at most, which is allowed to be that of musket-shot, or the fire of the musketry will be of no service: the number of the redans, therefore, must be increased, which requires more time, more hands, and a greater quantity of materials.

I acknowledge that the above imperfections will prove of less consequence if the works be supplied with a numerous artillery, because it is easy to direct its fire obliquely, and that the reach of cannon-ball is much more considerable than that of musket-shot; but we have not always a number of pieces of cannon at our disposal; moreover, why should we reduce ourselves to one mode of defence, where we can so easily procure two?

To procure these two modes of defence, in the present case, it will suffice that the curtains be broken, by which I mean, that,

instead of being in a straight line, as the author proposes, they should form a salient-angle, the summit of which should be in the same alignment with the points of the redans, which operation is equally simple and easy in the practice.

Join the points *a* and *b*, Plate 41, (supp. 2, fig. 2,) by means of a right line, divide this in two equal parts at the point *c*, then draw the lines *c d*, *c e*, which will form the two parts of the broken curtain.

By means of this slight alteration the angle which each face of the redans makes with that half of the curtain next to it, being hardly more open than a right-angle, those two parts will mutually flank each other, in their whole extent, and at a proper distance, by a cross fire: the ditches also will be better defended; in short, the redans may be more distant from one another, and even be placed at one hundred and fifty toises asunder, which, with regard to the fire of the faces, is in my opinion the greatest distance admissible: but then their construction must be altered. This alteration consists in giving to the perpendiculars *A g*, *B h*, *C i*, &c. (vide Plate 41, supp. 2, fig. 1,) one-fifth part of the front,

that

that is to say, of the distance between the points of two redans; and to each demi-gorge *A a*, *A b*, &c. a length equal to the half of those perpendiculars, and one toise more, which will prevent the salient-angle being too acute. With regard to the method of tracing the redans, and breaking the curtains, it is the same as in the former cases.

SECT. II.

Intrenchment with Tenailles.

To trace an *intrenchment with tenailles*, (vide Plate 41, supp. 2, fig. 3,) on a right line *a g*, set off one hundred toises from *a* to *c*, from *c* to *g*, &c.; divide the lines *a c*, *c g*, in two equal parts in the points *b*, *d*, and from those points erect the perpendiculars *b h*, *d k*, &c. each equal to the third part of *a c*, *c g*; lastly, draw the lines *a h*, *h c*, *c k*, *k g*, &c.; which will determine the parapet line of the work.

SECT. III.

Forts and Intrenchments with Bastions.

Bastions, properly speaking, belong to permanent fortification, but as they are sometimes used in the field, I shall explain the manner of tracing them.

Forts with Bastions.

Let us suppose, that a fort with bastions is to be constructed, a square fort for instance. (Vide Plate 40, supp. 1, fig. 1.)

First, at the point *c* divide into two equal parts the side *a b*, which I shall suppose to be one hundred and twenty toises long, and from the said point *c* draw a perpendicular *c d*, one eighth of the length of the side *a b*. If instead of a square fort, you want to construct a pentagonal, or hexagonal one, that is to say, a fort composed of five or six bastions, the length of the perpendicular would be different: in the first case it ought to be one seventh part of the side *a b*, and in the second one sixth.

From the extremity *d* of this perpendicular, and the points *a* and *b*, draw the lines *a d*, *b d*, of an indefinite length.

Next divide *a d* and *b d*, both into three equal parts, and carry one of those parts from the point *d*, to *e* and *f*.

From the point *e*, and from *f*, draw *e g* and *f h*, perpendicular to *b d* and *a d* produced.

Finally draw the line *g h*, and the line of the parapet is then traced in the direction

rection of the lines *a e*, *e g*, *g h*, *h f*, and *f b*. The same thing is to be done for the other sides of the fort, which then will be regular.

The works *g e a e g* at the angles of the fort are called *bastions*, the parapet *g h* between the two bastions is called the *curtain*. The bastion is composed of *two faces*, *a e*; and of *two flanks*, *e g*. The angle *e a e*, formed by the two faces, is called *the flanked-angle of the bastion*; the angle *a e g*, formed by one of the faces and one of the flanks, is called the *angle of the shoulder*; and that, *e g h*, formed by the flank and the curtain, goes by the name of *the angle of the flank*. The line *a b*, which terminates at the summit of two adjacent bastions, is called *the exterior-side of the polygon*. The line *k l*, which terminates at the centre of two adjacent bastions, is named *the interior side of the polygon*. The lines *a h*, *b g*, which are only a continuation of the faces till they meet the curtain, are called *lines of defence*, and are said to be *grazing*, or *rasant*, when, as in the present case, they meet the curtain at the angle of the flanks: but if the faces were so disposed, that their prolongment, instead of being carried to the angle of the flank, termi-

nated at any other point of the curtain, the lines of defence then would be termed *fichant*, and the part of the curtain between the point at which the prolongment of the face terminates, and the flank opposite that face, is called *second flank*; it is also said in the first case, that the fire is *grazing*, or *rasant*, and in the second case, that it is *fichant*. The line *k a*, drawn from the centre of the bastion to the summit of the flanked angle, is called *the capital*; and those *k g*, *h l*, formed by the prolongment of the curtains as far as the centre of the bastion, are called *demi-gorges*. Lastly, the angle *g k g*, included by two demi-gorges, is called *the angle of the centre of the bastion*; and that *e d f*, formed by the intersection of two lines of defence, is called *the angle of the tenaille*.

Intrenchments with Bastions.

Sometimes instead of redans, bastions are erected at proper distances to fortify a post; they must be traced as follows: on a right line *a b* (Plate 41, supp. 2, fig. 4.) set off 120 toises from *a* to *c*, from *c* to *b*, &c. divide *a c*, *c b*, into two equal parts at the points *d* and *e*, and from these latter draw the perpendiculars *d f*, *e g*, of 25 toises each; draw

draw the lines *a f*, *c f*, *c g*, *b g*, and produce them indefinitely beyond the points *f* and *g*; on these lines take *a h*, *c i*, *ç k*, *b l*, each of them equal to 35 toises, for the faces of the bastions. Next, from the points *h*, *i*, draw *h m*, *i n*, perpendiculars to the prolongment of *c f*, *a f*, and from *k*, *l*, draw *k o*, *l p*, perpendiculars to *b g* and *c g* produced; then *h m*, *i n*, *k o*, and *l p*, will be the flanks. Lastly, draw *m n* and *o p* for the curtains, to complete the plan of the parapet.

An intrenchment with bastions constructed in the above manner, may certainly afford a good defence. The curtains especially are defended by so many different fires, that they appear, as it were, inaccessible; (vide Plate 42, supp. 3, fig. 1,) however, this apparent advantage is attended with a very serious inconveniency, namely, that of dividing the fire unequally, in such a manner that the faces, which being the most salient parts, and are consequently the weakest, are the less defended; and indeed, as the capital has no other defence than that from the flanks, which do not exceed about 25 toises in length, it is obvious that the enemy can advance within 25 toises of the bastion towards the flanked angle, without having

any

any thing to fear; besides, according to the disposition of the ditch, which is parallel to the face, to the flank, and to the curtain, the counterscarp opposite the angle of the shoulder, necessarily masks part of it, so that the enemy cannot be discovered there from the opposite flank. This former defect may be remedied by breaking the curtain, as we have done with regard to the redans, so that the summit of the salient angle *m f n*, where the curtain is broke, (vide Plate 42, supp. 3, fig. 2,) be placed at the point where the lines of defence intersect each other. The latter defect will also be remedied by cutting away the ground opposite the angle of the shoulder, so that, from the flanks, you may discover the ditch at two feet or two feet and a half, at least of its bottom. (Vide Plate 42, supp. 3, fig. 3, *a* and *b*.)

SECT. IV.

Intrenchments en cremaillière, or indented Intrenchments.

On the line *a k*, Plate 43, sup. 4, fig. 1, set off 60 toises from *a* to *b*, from *b* to *c*, &c. &c. and at the points *b*, *c*, &c. erect the perpendiculars *b f*, *c g*, &c. each of them 15 toises; draw the lines *a f*, *b g*, &c. and let *b h*, *c i*, &c. be

equal

equal to 5 toises; finally draw *f h*, *g i*, &c. and the line of the parapet shall be completely traced. The Plate will shew that the small flanks *f h*, *g i*, &c. forming nearly a right angle with the branches *h g*, *i m*, &c. which they defend, all their lines of fire are nearly parallel to those branches, and their direction at no greater distance than five or six toises from the adjacent flanked angle. Now as the length of those branches *h g*, *i m*, &c. is only half musket-shot each of them, the branch *i m* for instance is defended, not only by its own flank *g i*, but by that *f h* of the branch *h g*, which is before it.*

Another advantage which indented intrenchments offer, is that, their salient angles being double in number to those of every sort of intrenchment, since we suppose them placed at half musket-shot, they project less towards the

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* This elucidates what I have said in the note of maxim 3, respecting the length of the lines of defence which were not intended to cross each other although prolonged. It may be seen that the lines of fire which come from the flanks *f h*, *g i*, and both cover the branch *i m*, are not intended to cross each other although prolonged. If those flanks were at a greater distance from one another than half musket-shot, or, which is exactly the same, if the line of defence exceeded sixty toises, the branch *i m*, could no longer be defended by the flank *f h*.

country,

country, and of course are not so much exposed; besides, on account of those angles not being very projecting, and the branches being very short, it is much easier to preserve the determined alignment, and to take better advantage of the ground; in short, it is the only mode of tracing, which will procure a direct fire parallel and uninterrupted, and generally a fire equally distributed on all sides.

SECT. V.

Intrenchment with Lunettes.

I have already explained in the supplementary chapter of definitions, what was meant by intrenchments with lunettes; but I must farther observe that the object of lunettes, is to keep off the enemy at a greater distance, and that they may be sooner exposed to our fire, and during a longer time. Respecting the communication, it is obvious that its only end is to secure the passage from the lunettes to the intrenchment, whether the troops which defend them are to be reinforced, or whether those troops are forced to evacuate them and to retreat. I therefore shall proceed to explain in what manner those intrenchments are to be constructed.

On

On the front line of the intrenchment to be constructed, take *a b*, equal to 120 toises; (vide Plate 43, supp. 4, fig. 2.) bisect it in *c*, and from that point draw a perpendicular indefinitely produced both inwards and outwards; from *c* to *d* set off 35 toises, and draw the lines *a d*, *b d*. From *d*, set off 25 toises to *e*, and 18 toises to *f* and *g*; draw the lines *e f*, *e g*; then make *c h* equal to 60 toises, and *a i*, *b k*, each 20 toises. Lastly, draw the lines *h l*, *h m*, and from *h* set off 25 toises to *l* and *m*, then will *h l*, *h m* be the faces of the lunettes. According to this construction, the faces *h l*, *h m* of the lunettes, are defended by an almost grazing fire from the parts *a i* and *b k* of the intrenchment, both equal, as above said, to 20 toises; and the branches *a f*, *b g* of the intrenchment, from *e f*, *e g*, both equal to 22 toises; the front *b x*, on which all the lines of fire are drawn, shews that the parts of the branches *p g*, *r s*, fire in the directions *y*, *o*, close to the lunette, and flank likewise the salient angle *g z r*. There is no fire from the parts *n p*, *s t*, on account of the lunette in their front.

The gorges of the lunettes are closed by palisades, in order that they may be secured in the rear from the enemy. There is only a

small

small passage left for the opening of the communication, and which is from twelve to fifteen feet wide: but in proportion as it draws nearer to the intrenchment it must be widened; it may even be twenty-five or thirty feet at the extremity towards the intrenchment. By this means, supposing that the enemy, after having rendered themselves masters of the lunettes, would advance within the communication, they would be discovered on a front double to theirs. Moreover, you will by this means avoid the flanked angles of the intrenchment being too nearly grazed by the fire from the communication, which would take place if it was equally wide in its whole extent.

With regard to the height of the communication, it is to be observed that if it were too high it would mask the fire from the branches of the intrenchment: if, on the contrary, it was sunk too low, the enemy would not be sufficiently discovered, and it would be exposed to a plunging fire from the country. In order to avoid both these inconveniences, let it be sunk sixteen inches, and its parapet be elevated three feet above the ground, and then it will be of a proper height. The summit of this parapet is to have no slope, in order

that

that the fire may graze the country horizontally: this is supposed to be level, for if the country was sloping, proper measures must be contrived to graze it in a parallel direction. There are two reasons for not allowing a banquette to the sides of the communication; the first, because a banquette, which cannot be less than four feet wide, including the talus, would necessitate that of the communication to be increased eight feet, from which you would be more exposed to be battered in reverse. The second reason is, that the less the communication is open, the more the enemy are exposed there to the fire from the intrenchment.

Now, as that part of the intrenchment which is opposed to the communication is an angle, from which a sufficient fire cannot be expected for its defence, a kind of tambour, in form of a glacis, is constructed at the extremity of the communication nearest to the intrenchment, the branches whereof are drawn back in a parallel direction with the faces of the redans, as may be seen in Plate 43, sup. 4. fig. 2 and 3; and in the middle of it a traverse is also made, which answers a double purpose, since it covers likewise the entrance of the intrenchment.

Lastly,

Lastly, we have supposed the lunettes to be only 120 toises distant from one another, and as it is impossible to prevent two parallel lines battering each other at right angles, we must conclude that if the front of the intrenchment is in a right line, and therefore the communications parallel, their fire must reciprocally annoy each of them. The only method of remedying this inconvenience is to have the lunettes stand at a greater distance asunder, and only to construct them opposite each second front.

SECT. VI.

Formation of Works by means of bags filled with earth.

In order to accelerate the construction of works, at least in certain cases, when great expedition is requisite, it has been proposed to erect parapets by means of small bags filled with earth, which are one foot diameter, eighteen inches long, and made of coarse canvas dipped in tar.

This method indeed would have the advantage of accelerating the construction of works, insomuch that as it is very immaterial from whence the earth to fill the bags is taken, the

men

men might be scattered over the ground, nay, a greater number might be employed: besides, these bags are soon filled and placed, and when properly disposed, require neither revêtements nor embrasures: therefore the time and trouble requisite for preparing the materials, and making the revêtements in the usual manner, might be saved.

But a work of this kind has no ditch, and consequently it is easy for an enemy to approach and climb it. This inconveniency cannot even be remedied by using palisades, fraises, or chevaux-de-frise, which the enemy's cannon would soon destroy. With regard to the other obstacles which may be opposed to the enemy, such as abbatis, trous-de-loup, fougasses, &c. if there is time enough to construct them, the whole work might for the same reason be carried on in the usual way. Besides, let us consider the immense quantity of bags which must be provided for an intrenchment even of an inconsiderable extent, the expence of these bags and others to replace such as must unavoidably be lost or damaged in using them, the number of carriages necessary for their conveyance, and many other inconveniences.

This method, therefore, is only applicable

when you are obliged to cover yourself in a hurry on a small extent of ground; for instance, when after having crossed a river, you wish to construct a tête-de-pont; or when a landing on a coast being effected, and an immediate attack expected, the troops that are landed first want to cover themselves in a great hurry; in such cases a covering of bags may be useful to mask the work that is to be constructed, and to protect the troops, but in no others. It is first to be traced on the ground, according to the figure which is thought proper, next the bags are placed one above another, and as close as possible.

SECT. VII.

Intrenchments with detached or single works.

I have hitherto supposed intrenchments connected together, that is to say, *without any unfortified intervals.* However, it will sometimes happen, particularly when there is an apprehension of being short of time, of materials, or when you are not greatly inferior in number to the enemy, that unconnected intrenchments, sometimes even *single works,* are constructed from distance to distance on the extent

tent of the front which is intended to be fortified. If you are attacked in this situation, it is a great advantage for you that the enemy cannot pass between those intervals without previously rendering themselves masters of thosè unconnected works, or without being battered in flank.

However, when you construct intrenchments of that kind, you must take care that the works, which must be large enough to contain at least two hundred men, be so disposed, as mutually to protect, and not to batter each other, or those which may subsequently be constructed to fill the intervals. Those unconnected works ought not to be nearer one another than 120 toises, but their distance asunder may be carried to 200 toises; and although in this case the fire of the musketry would be of no service to protect the faces, nevertheless it will suffice for the defence of the intervals, which defence may be still encreased by placing there troops and cannon.

If these unconnected works were to be redoubts, and that you would wish to place a second row behind the first, you must then produce the faces of those in the first row, and the point at which they intersect will determine the

gorges of those in the second row. (Vide Plate 43, sup. 4. fig. 4.)

SECT. VIII.

Distance of the camp.

The distance of the camp from the intrenchment is usually about 100 toises; it might be dangerous either to increase or to reduce it: in the former case, the troops would be too far from the works which they are to defend, and in the latter they would not have the space necessary for manœuvring with facility, nor leave in their rear a passage sufficient for the march of the corps dispatched to the relief of those places that may stand in need of it. This distance, however, although generally adopted, may be modified, as the ground may require a more considerable distance, at least in certain cases, but it ought never to be much smaller.

SECT. IX.

Of entrances.

I have already mentioned, in one of the notes, the danger of making the entrances too spacious, and that, to facilitate *sorties*, which I strongly recommend (as may be seen in the supplementary chapters, on the attack and defence

fence of field-works), I should prefer having them nearer to each other. Here I must, however, add, that their number must depend on the designs of the general, the nature of the ground in front, and the strength of the entrenched army; for, if this army be, for instance, considerably inferior to that of the enemy, if the intrenchments be accessible only at a small number of points, or if the space in front be not sufficient for forming the troops, it would then be useless to multiply the entrances; but if these different cases, which I consider as exceptions to the rule, do not occur, the number of passages cannot in general be too numerous, and conformably to this principle, I think the entrances are not too near together, if they be placed at the distance of 150 or 200 toises from each other.

SECT. X.

Manner of covering entrances.

Entrances ought to be placed in such positions where the best cross-fire can be obtained, and if time and circumstances permit, they should be covered by the following methods.

In intrenchments with redans, as proposed by Gaudi, that is, where the curtain is straight,

(see Plate 45, supp. 6, fig. 1,) erect in the middle of the curtain a perpendicular *a b*, to which give 22 toises; make the demi-gorges *a c*, *a d*, each equal to 17 toises two feet, and draw the lines *b c*, *b d*, on which you must measure *c f*, *d g*, each equal to 10 toises.

The remaining parts *f b*, *g b*, of these lines will be the faces of the work. Then make *c e*, *d h*, each equal to five toises, and lastly, draw *f e* and *g h* for the flanks.

These flanks are useless by themselves, as appears from the figure, because the fire which would proceed from them would batter the opposite redans; but as they shorten the faces, the curtain is masked to a less extent than it would be if the faces were prolonged to the ditch of the intrenchment. It is however masked to the extent of about 25 toises, which I confess to be an inconvenience.

The ditch of these works besides should be prolonged, in a direction parallel to that of the faces, to the ditch of the intrenchment, that it may be discovered in its whole length; and as all the earth taken from it cannot be employed, you are put to the trouble of removing it. Notwithstanding these inconveniences, these works produce a very good effect, for the

fire

fire of their faces crosses at a short distance from the salient angle of the redans over their capital, which, as I have before observed, stands in great need of this assistance; they likewise completely cover the entrance of the intrenchment, and the bridge erected over the ditch.

As to intrenchments with redans, where the curtain is broken, the entrance cannot be placed better than at the salient angle of the curtain; and to cover that entrance, construct in front a fleche *a b c* (fig. 2), the summit of whose angle is 16 toises distant from that of the salient angle of the curtain, and whose faces, which must be 20 toises in length, are in a line with the re-entering angle *d* of the redans, the fire of which being perpendicular, will thus graze, and not batter them. This method is applicable only to the second scheme of intrenchments with redans, that is, to those where I have supposed the redans to be 150 toises from each other, and which I prefer in every respect to the former. Finally, if the ditch of this fleche be dry, the earth must be cut away to the extremities *a* and *c* of the faces, that the enemy may not have any shelter there.

In intrenchments with tenailles, construct at

the re-entering angle formed by the branches a fleche *a b c*, to which give 20 toises of capital and 15 of demigorge. Prolong its ditch in a direction parallel to the faces to the ditch of the intrenchment (fig. 3).

In intrenchments *en cremaillière*, prolong one of the branches *a*, and close up the work by a new flank *b*, parallel to the first *c*, and at the distance of ten or twelve toises from its ditch (fig. 4).

I shall say nothing of intrenchments with lunettes, because that part of the branches of the communication, between the tambour and the ditch of the intrenchment, covers the entrance.

There are two methods of closing the entrances of intrenchments with bastions, the curtain of which I here suppose to be broken. The first consists in constructing, in front of the curtain, and at the distance of 10 toises from its ditch, a second curtain parallel with the former (fig. 5). In this manner carriages may pass without difficulty, and the flanks of the bastions will project far enough beyond this second curtain to flank it with a sufficient fire.

The second method consists in breaking the curtain a second time, which is done in the following

following manner. From the angle of the shoulder *a* of a bastion to that of *b* of an adjacent bastion (fig. 6), draw a right line *a b*, and divide it into two equal parts at the point *c*. From the same point draw in the inside a perpendicular line *c d*, equal to half the line *a b*; then from the extremity *d* of this perpendicular, and through the points *a* and *b*, draw two lines *a d*, *b d*. In this manner the curtain, which was at first broken in the direction *e f g*, will likewise become so in that of *e d g*, and the reentering angle which it forms at the point *d*, will be covered by the angle *f*, which belongs to its first tracing.

It is to be observed that the angle *d* being a right angle, and the direction of its branches grazing the shoulders *a* and *b* of the bastions, the fire proceeding from these branches and facing their ditches, though less advanced towards the country than it was by the first tracing of the curtain, will pass farther beyond the capitals of the bastions, and will intersect them much nearer the flanked angle, which cannot but be of advantage. The inspection of the figure will completely explain this method, which I acknowledge is more complicated than the former.

SECT.

SECT. XI.

Method of adjusting the length of the fronts to the ground.

As the ground does not always permit you to allow the fronts the extent I have given them in the construction of the different intrenchments, of which I have treated in this chapter, that extent must sometimes be increased or diminished.

The front of intrenchments with redans may be 30, or even 50 toises shorter than I have fixed it, only observing to break the curtain as I have directed.

The front of intrenchments with tenailles may, without inconvenience, be reduced to 50 toises, but the perpendiculars *b h*, *d k*, (see Plate 41, supp. 2, fig. 3,) must likewise be diminished, so as never to exceed the half of that front.

The branches of intrenchments *en cremaillière*, which I have fixed at 60 toises in length, may likewise be reduced to 30 ; but the flanks *f h*, *g i*, (see Plate 43, sup. 4, fig. 1,) which in this case must be made perpendicular, ought at least to be 12 toises, and the branches should also be defended, not only by their own flank,

but

but by that of an anterior flank, as they are when the front is 60 toises.

Lastly, the front of the other intrenchments may be diminished one fourth, observing that all the dimensions of the works be diminished in the same proportion, that the direction of their fire may always continue the same.

I shall still observe that in general it is more advisable to diminish the fronts than to lengthen them too much, since they are almost always rendered stronger by the former method, and must necessarily be weakened by the other.

I shall conclude this supplementary chapter by observing, that hitherto I have supposed regular works constructed on a ground so perfectly level, that they could be erected with as much regularity as if it were done on paper; but as I have already said, neither can it be repeated too often, the ground varies continually, and it is impossible therefore to prescribe rules applicable on every occasion. An officer accordingly cannot labour too hard to improve his *coup d'œil*, to acquire a knowledge of ground, to discern the advantages and inconveniences it offers; in short, to learn how to take every advantage. When possessed of this knowledge, he will easily be made sensible what sort of work it will

be

be more proper for him to construct according to the ground, and will moreover seize those necessary irregularities, in order that the works may answer the intended purpose.

CHAPTER VIII.

(SUPPLEMENT.)

Of Glacis, Covert-ways, advanced Ditches, &c.

I HAVE already stated the inconveniencies resulting from the summit of the parapet having a considerable slope, and indeed in whatever manner it may be determined, it will always be attended with inconveniencies; for the enemy cannot be discovered when close, unless the slope is considerable, and, as I have observed before, the greater it is, the less grazing will the direction of the musketry be; so that, for want of being able to allow the parapet a sufficient slope, on account of this last inconveniency, in proportion as the enemy draws nearer the counterscarp, the less he is exposed to the direct fire; a most essential inconvenience, especially in works without flanks of their own or of a certain elevation. This may be remedied by constructing on the edge of the counterscarp,

terscarp, small glacis, upon which the enemy, in their ascent, will be easier discovered from behind the parapet. However simple the construction of these glacis be, yet it requires some attention; for if they were too elevated, the enemy would take the advantage of a plunging fire; and if, on the contrary, they were too low, they would not answer the intended object. It has been decidedly agreed, that the utmost height that can possibly be given to the glacis, must be as follows; let its summit be level with the banquette; therefore, if we suppose that a parapet six feet high, be elevated four feet four inches above its banquette, the height of this latter, and consequently that of the glacis, will be one foot eight inches. This height must never be exceeded, though, according to circumstances, it may be lessened, but then the slope of the parapet must serve as a regulator, since the object of the glacis is chiefly, that the enemy may be discovered at least two feet above the horizon, when on the counterscarp, where they generally stoop.

With regard to the slope of the glacis, it must be such, that on every point of it the enemy be entirely discovered, or at least two feet above the horizon. The construction of

the

the glacis, in general, is the most perfect, when, without being too elevated, its slope is in a parallel alignment with the slope of the parapet. (Vide Plate 44, sup. 5, fig. 1, which represents the profile of a glacis of that kind.)

The glacis have another advantage, besides that of the enemy being easily discovered from a nearer distance; namely, of adding to the depth of the ditch, by raising the counterscarp, and in such a manner that the bottom of it is not less discovered; they cover also part of the work from the artillery's fire. Sometimes a covert-way is added to the glacis, fig. 2, 3, but then the counterscarp must be lowered, as the figures will shew, in order that the summit of the parapet of the work may retain its proper height over the glacis.

The intended object of the covert-way is to procure a grazing fire, which cannot be expected from the parapet of the work, till the enemy has reached the top of the glacis. Clairac proposes likewise to have the summit of the glacis level, for some feet, as expressed *s*, *s*, fig. 2, 3, in order that the fire may follow that direction, which if the ground is flat and level, as he supposes, is the most advantageous that can be procured; in fig. 3, the glacis has a

banquette,

banquette, upon which is placed a row of palisades. In fig. 2, the berm *l*, instead of being horizontal, is cut so as to incline towards the ditch, and in fig. 3, it is of a convex shape, which is intended to prevent the enemy, after they have crossed the ditch, from having a footing and gaining breath there.

I have already observed in the chapter of maxims, that an advanced ditch is never to be constructed in dry ground, unless it may be discovered and enfiladed in its whole length, from some parts of the intrenchment. The same method which I have recommended respecting the other ditches is to be adhered to in this case, by which I mean that the ground must be cut away in every part where the counterscarp might prevent the bottom of an advanced ditch from being discovered. I shall farther add, that as the earth dug out is seldom wanted, unless to complete the above mentioned glacis, it is made in general rather inconsiderable. I should prefer, therefore, whether it be dry or filled with water, that it should be pointed at bottom. In the former case, the enemy could not hold in; in the latter, they would find it equally difficult to pass; its depth ought always to be at least six feet, and its

width

width at least seven, that the enemy may not leap over.

CHAPTER IX.

Scheme for fortifying a Town or City.

POSTS of these kinds are likewise put in a state of defence on different accounts; sometimes to cover a magazine, or to keep up a communication with some place of great consequence; sometimes in order to defend a defile, and dispute a passage, or to make it a winter quarter or cantonment. Whatever may be the motive, however, it is requisite that a strict examination into the following particulars should take place, previous to the proper arrangements to be made in consequence of such a resolution: whether there is any probability that the enemy will immediately make any attempt, or merely postpone it for a short time; which is the most easy side for them to approach by; how soon any of their movements can be known; and in how much time the post can be succoured; whether, if in danger of a surprise, or threatened with a

sudden

sudden attack, a reinforcement could arrive in time; and lastly, whether this succour is expected to come from the camp, or from the neighbouring quarters.

The utmost attention becomes necessary when there are positive orders to defend a post to the last extremity: neither is it possible to be too particular in making the disposition against the attack. In this case the lying of the ground near the town, the situation of the place itself, with the state of the walls and buildings, must determine, as well as in all other cases of the same nature, in what manner the post should be fortified. All that has been said before upon this subject must be strictly observed; and if the town is ordered to be maintained, cost what it will, the following directions must be carefully attended to.

SECT. I.

The commanding officer must require of the magistrates to give in an exact account of the number of inhabitants, and of the provisions that are in the place. If there should happen to be any citizens suspected of holding a secret correspondence with the enemy, they must be immediately turned out: but if in an

enemy's country, where of course the generality of the inhabitants must be suspected, all their arms must be taken away from them; and they be strictly forbidden, under pain of death, to appear in the streets, in case of an alarm in the night: they are farther ordered to remain quiet in their houses, with their doors shut, and candles in their windows.

SECT. II.

Those provisions found in the town, on which the garrison can subsist for a few days, must be collected, and carefully laid up, in any church, old castle, or stone building not exposed to fire, and which must immediately be put in a state of defence. This little magazine is not to be touched till the enemy have either blocked up, or closely attacked the place, in fine, till no other provision can enter the town. Now, if the place cannot furnish a sufficient quantity, the environs must be diligently searched to procure enough. This is a most necessary precaution, for it will sometimes happen that the garrison are obliged to wait several days for a fresh supply. In the mean time subsistence must be provided for the garrison, in order that they may not be

forced

forced through famine to accept of the terms which the enemy would wish to impose.

SECT. III.

When a town is situated in a plain, not in any manner commanded by heights, and the walls in good condition; the following disposition must be made to defend it properly.

All the gates on that side next the enemy, must be strongly barricaded with large beams, and chests or casks filled with earth or stones placed behind them. In case neither of these can be procured, dung thrown up as high as possible against the gates within side, will answer nearly the same purpose. On the outside, strong palisades must be planted, and a ditch pointed at bottom made, to defend the approach; all along the front of the ditch, large entire trees are laid, the branches being well entangled. These precautions being taken, it is hardly probable the enemy should attempt to penetrate that way.

On the other hand, one or two of the gates leading to the army must be kept open by way of communication; but then a sufficient quantity of materials must be kept in readiness, and quite near the gates, to barricade them as

soon as the enemy is seen to advance that way. In order, therefore, to be able to carry this into execution, without danger of being forced before the barricading is completed, the gates must be covered by fleches or tambours, with only an opening left wide enough for a carriage to pass. It is likewise necessary to secure the entrances into the tambours, either with loop-holed gates, or with barriers made in the form of chevaux-de-frise, fastened with a padlock, and which may be either raised or lowered as circumstances may require. Should one or several canals enter the town under the walls, they must be shut up with strong iron gates, and centinels posted to guard them.

SECT. IV.

The gates being thus sufficiently secured, the walls are next to be put in a proper state of defence, consequently repaired when decayed or broken down, either with masonry or large beams. If there is time enough, a scaffolding should be erected within-side all around; but if this cannot be done, it must at least be constructed on each side of the gates, where it is of greatest importance, as well as at the angles and other weak parts. At these places a

double

double row of loop-holes should likewise be pierced, six inches wide without, and twenty within, that several men may be able to fire through together. They must be three feet and a half high on the outside, and two feet and a half within, sloping a little outwards at bottom, that the enemy may be discovered even when close to the wall. The towers, and every other projecting part inside of the circuit of the wall, must have a double, and if possible a triple row of loop-holes, in order to obtain a cross fire; but if the wall should not be high enough, banquettes only may be thrown up behind it, as mentioned already with regard to the walls of church-yards.

All around the wall, a chain of centinels must be posted, both night and day, on the scaffolding. The cannon are to be placed at such parts as are most likely to be attacked; and in order that they may be of greater service, scaffolds, or large elevations of earth, should be raised to support them, or at least openings made in the wall, to answer the purpose of embrasures.*

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* As it is probable that the enemy will endeavour to dismount your cannon as soon as he knows its position,

SECT. V.

If a stream runs near the town, dams are laid across to stop the current and form an inundation; at the same time, in order to prevent the enemy from using those dams as bridges, and hinder them from cutting the dams to drain off the water, large branches, and even whole trees are used to obstruct the passages. The dams should also be disposed in such a manner as to be defended from the wall with musketry. This method is productive of very great advantage, for when the inundation is thoroughly completed, that side of the town is perfectly secured against an attack.*

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a parapet made of earth is preferable to embrasures pierced through the wall, because the splinters of stone that may fly about, are a great nuisance to your artillery-men.—TRANSLATOR.

* These dams must be defended not only by the fire of the musketry from the wall, but by detached works, which will protect them so much the more efficaciously, that they may be disposed in the most favourable manner, without your being obliged to keep to the same direction with the wall. When there is time and means sufficient, the defence of the dams cannot be made too secure, since if the inundation is truly capable to stop the enemy, they cannot approach the town unless they drain off the water, or, as the author observes, unless they make a bridge of the dam.—TRANSLATOR.

SECT.

SECT. VI.

We must repeat again that all the brush-wood, hedges, trees, &c. within musket-shot, which might serve to conceal the approach of the enemy, must be cut down; and if the post is to be defended to the last extremity, the very suburbs must be destroyed by fire. Small detachments should be posted at the tops of the steeples, from whence the whole country around may be thoroughly discovered, to give information of all the enemy's movements. Spies must also be used to procure every possible intelligence. Great fires must be lighted towards dusk, at about an hundred paces from the wall, and between two or three hundred from each other; these fires being kept during the night by certain people appointed, and chosen amongst the inhabitants, and regular patroles being sent, there can be no apprehension of a surprise.

SECT. VII.

A plan of rendezvous must be fixed upon, and every individual made perfectly acquainted with his post, that he may repair thither in case of alarm; but if the enemy are near at

hand, and that they are expected to approach, the men, instead of continuing in their quarters during the night, must remain in those houses that are most contiguous to the rendezvous appointed, fully dressed and accoutred, that they may more speedily gain their post when the signal is given.

At those parts where the wall is in good condition, a few men will be sufficient to defend it, but the largest proportion of troops must be assigned for the defence of the weak part. The main-guard, which forms the reserve, is re-inforced in case of an alarm, as well as all the other posts.

SECT. VIII.

A place of this kind, to be properly fortified and defended, requires every circumstance to be maturely weighed and examined, as also the orders which have been received. If the place is to be maintained to the last extremity, all possible means and contrivances must be used not to be forced. The commanding officer must be able to distinguish easily a false, from a true attack; the first he will not trouble himself much about, but endeavour to receive the latter with resolution and good conduct. If

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the enemy should attempt to force one of the gates, and to batter it with their artillery, with the view of making an assault, their design is no sooner perceived than a breast-work must be thrown up within-side, opposite to that gate, at a distance of about twenty or thirty paces.* This may be constructed with large pieces of timber piled one upon another, carts loaded with dung, &c. Cannon loaded with grape-shot must be placed behind this work, and pointed at the gate, ready to fire upon the enemy, if they should attempt to storm after they had completed the breach.

Against whatever part of the wall the enemy direct their attack, they will endeavour to succeed either by escalade or battering in breach. The former design may be opposed by placing beforehand large beams or logs of wood upon the top of the wall, and tumbling them upon those who mount the ladders, when it is no longer possible to repulse them by firing through the loop-holes. The other design of

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* This is the case of using to great advantage your cannon, by endeavouring to dismount that of the enemy when battering in breach, or trying to shatter the gates.—TRANSLATOR.

entering

entering by the breach may likewise be rendered abortive, by filling it up immediately with logs and large branches, which are instantly set on fire, as we have already mentioned in the defence of a church-yard; plenty of fuel must also be constantly supplied. If materials can be procured, a breast-work may be constructed behind the breach, and a sufficient body of troops posted, ready to receive the enemy when they attempt to force their passage. The middle and upper stories of all the houses which command the breach, ought to be filled with soldiers. If the garrison should succeed in repulsing the enemy, the breach must be immediately barricaded, or continued to be filled up incessantly with logs and large branches, which are instantly to be set on fire. However, if it is perceived that all these precautions will be ineffectual to keep out the enemy, a retreat must be thought of, and effected by retiring to the church, or any other building where the provisions have been collected, and which, as recommended above, must have been previously put in a proper state of defence. Those men who are not actually engaged, first march to this new post, and those who defend the breach follow next, leaving

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ing a few tirailleurs * to fire upon the enemy and cover their retreat. When reduced to such a critical circumstance, it will easily be conceived how infinitely important it must be to have the streets leading to the church, or to any other post that is to be defended, strongly barricaded either with logs of wood, or carts filled with dung. Small openings, sufficient for two or three men to pass abreast, should be left in these retrenchments, and a few soldiers only placed behind them, to cover the retreat of the rest.

In such a dilemma the commanding officer must regulate his conduct according to the times and circumstances, the state of provisions and ammunition, the loss he has already sustained, the probability of receiving speedy relief, or the improbability thereof, but especially according to the orders that have been given him. We will not pretend to say that the above rules are strictly to be adhered to, or

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* Skirmishers or marks-men advanced in front to annoy the enemy and draw off their attention, or left behind to amuse them and stop their progress in the pursuit.—TRANSLATOR.

that they are such as cannot be departed from without an officer disgracing himself; we only proposed them as natural ideas which will occur most likely, when a desperate defence is become necessary, for which there can be but two occasions; the first, when the enemy insists upon terms too hard or dishonourable; the second, when there are positive orders to defend the post to the very last: these orders, by the by, are never given, unless when under the cruel necessity of sacrificing a handful of men in order to save a whole body of troops.

SECT. IX.

If the town to be defended should be without walls, and only surrounded with gardens, no exertion or contrivance whatever will prove successful; the post can never be made to hold. All that can be done is to construct fleches all around it, at certain distances, and which mutually flank each other. Trees in form of an abbatis are placed instead of curtains. However, no other advantage is to be derived from such a post, but preventing a surprise, for if a regular attack is made with cannon, the post can be of no manner of use.

SECT. X.

If a place of this kind should happen to be commanded by any height within the reach of small-arms, the most judicious measures that can be adopted for fortifying it, will avail nothing; all that can be tried is to construct a redoubt on one of the neighbouring heights, which the garrison should occupy on the approach of the enemy, as we have mentioned above in the case of a long straggling village, lying in a narrow vale, between mountains.

CHAPTER X.

Method of forming Inundations.

WE have already taken notice of the advantages which result from stopping the current of brooks, and overflowing the meadows on each side. By this means fords are rendered impassable, owing to which all the posts within a certain distance are so well covered, that an attack upon them is made impracticable. To form inundations of this kind, dams are laid across brooks or streams in the following manner.* (Vide Plate 36, fig. 1.)

* Before you form an inundation, you must previously ascertain, 1st. How much the height of the surface of the water

SECT. I.

If the brook runs through a flat ground, the banks being on a level with the rest, dams

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water at *k*, (Plate 36, fig. 1,) exceeds that of the surface at *e*; or, which is the same thing, what is the fall of the water from *k* to *e*. 2d. How much more elevated the ground is at *n* and *o*, than at the banks of the brook *l* and *m*. 3d. Whether, immediately in front of the intrenchment, and higher up the stream, there is any place where the banks are lower than at *n* and *o*; for in this case the water would run off and inundate the intrenchment, prior to its having reached the height of *n* and *o* at the dam. All these particularities will be made known by means of levelling, which is to be carried on as follows.

Let us suppose, for instance, that you wish to know what is the fall of the water through the extent *a b*, (Plate 40, supp. 1, fig. 12.)

Provide a certain number of pickets of different lengths, let us say from six inches to six feet; divide them into inches from top to bottom, and mark each division by a small notch; procure likewise a mason's level *g f*, ten or twelve feet long, with a line and plummet such as are in common use.

First, drive a small picket in *a*, so that its head be at about two inches from the ground: at ten or twelve feet of this first picket, according to the length of the level, fix another at *c*; then lay the level on the top of these two pickets, and drive the latter at *c* till the plumb-line exactly coincides with the perpendicular line marked upon the level; the tops of the pickets will then be in an horizontal line; then measure the height of the picket *c* above the ground,

a, *b*, about thirty or forty paces long, five feet broad, and five in height, are raised on each side.* The upper side, by which is meant that

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ground, and subtract from it the height of the picket *a*, the difference will shew the fall of the water from *a* to *c*. You may determine in the like manner, the fall of the water from *c* to *d*, from *d* to *e*, from *e* to *b*, and if you deduct from the height of the picket in *b*, the height of the picket in *a*, you shall find out the fall of the whole water from *a* to *b*.

This mode of levelling, though ever so simple, might still be abridged; but the method to be used as more expeditious, might perhaps be attended with more difficulty in the practice, I therefore shall not explain it.—TRANSLATOR.

* If the ground be flat, and if the banks of the brook are on a level, or nearly so, with it, then every idea of an inundation becomes chimerical, because the water running off with facility at each end of the dams, it will never acquire a sufficient depth, which is to be at least five feet: an overflow at most will be procured, which with the assistance of the small ditches, called creeks, which the author is going to mention, may be of some service. Now, if we suppose the banks much more elevated than the general height of the water, if for instance we suppose that *a e b*, (Plate 40, supp. 1, fig. 15.) represent the section of a brook, whose banks are elevated six feet above the general depth of the water, it is plain, that by means of a dam across the brook, the depth of the water may be increased six feet, so that the brook may no longer be fordable. But, as the wa-

towards the source, is lined with fascines, which are quite useless on the other side. Next, if the water is only three or four feet deep, a dam six or eight feet broad, and formed entirely of fascines, must be made across the brook, by laying one bed of them upon another, each being fastened with stakes, or loaded with stones, to prevent their being carried away by the current. But, if the water should be deeper, two rows of strong stakes, or piles four or five inches in diameter, must be driven close to each other, between the two dams. These two rows being eight feet asunder, will form a space *d e*, which is called the coffre, and is to be filled up with earth and stones.

By this means the course of the water being stopped, it will naturally overflow its banks; and as it is kept up by the dams *a*, *b*, it must unavoidably inundate the low grounds *f*, and consequently seek new passages *g*, *h*, at the extremities of the dams. (Vide Plate 36, fig. 1.)

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ter must never get above the dam, it would be proper either to raise up this latter one foot above the banks, or to keep the water one foot below them, leaving at both ends of the dam small openings through which the water may run off, when it is come to its proper height.—TRANSLATOR.

SECT.

SECT. II.

When, from the brook being very inconsiderable, it is apprehended that the inundation will not be sufficiently deep, small ditches *i*, called creeks, eight feet broad and four deep, may be dug here and there in the ground intended to be overflowed; which, however, is to be done before the coffre is completed, and the earth taken out of them thrown about on each side. As soon as the brook begins to overflow its banks, these ditches are naturally filled with water; by which means, although the inundation should be too shallow, the enemy will nevertheless find equal difficulty in passing it, as the little ditches can neither be perceived nor avoided.

Chevaux-de-frise, trees, branches, &c. are laid along the dams to prevent their serving by way of passages to the enemy. In proportion to the rapidity of the stream, the dam across it must be ten feet broad or more, otherwise it will soon be destroyed. If care be taken to lay it over at the most shallow part, it will save much trouble and labour.

SECT. III.

If the stream should happen to run in a narrow vale, with heights on each side, dams of the same kind above-mentioned must also be raised; but, in order that the inundation may be deeper, they should cross the whole valley, with a small opening only left at each extremity, that the water may run without being forced to overflow the dams, which would soon destroy them.* These two openings must

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* The length of a dam is generally determined by the nature of the banks, and the adjacent ground, in such a manner, that the more the ground is flat, or level, on each side, the more the dam is to be long; whereas, on the contrary, the more the one rises, the shorter the other must be. The proper and necessary length of it, may always be determined in the following manner. In the middle of a brook erect a perpendicular *e f*, (fig. 13, 14, 15,) at the same height as you wish your inundation to rise; an horizontal line which you will carry through the point *f*, will determine the points *a* and *b* on the adjacent spot, where the dam must end, and consequently its proper length.

The thickness of a dam must be such, that the constant pressure of the standing water, or the impulsion of the running water, may not destroy it; and the top of it must never

be lined with fascines the better to resist the new stream, and at the same time the dams are made more sloping at those parts,* to prevent the continual running of the water washing them away by degrees. (Vide Plate 36, fig. 2.)

SECT. IV.

If there should be a pond already made, supplied by a constant stream, and sluices established in the dam, which keeps up the water; and that in this case it should be considered requisite to enlarge the pond, or to lay

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never be less than four or five feet. This thickness should even be increased if an attack with artillery were apprehended, in order that the dam might resist the effect of cannon ball: care must also be taken, that it should have a considerable talus on the side opposed to the stream, the basis of which must be equal to, at least, double its height. The talus on the other side must be less. It is likewise advisable to drive a row of pickets across the brook in front of the dams; and to construct the latter so that they may form an oblique angle with the stream, in order that the water being diverted sideways, the effect of the impulsion of the stream may be lessened.—TRANSLATOR.

* It is proper the extremities of the dams should be made round, at that part where these openings are.—TRANSLATOR.

a greater extent of ground under water, the sluices must be shut till the inundation is completed, (admitting that the height of the head is sufficient for the purpose,) and are next to be opened again, but only just as much as necessary to let that quantity of water pass, which is constantly supplied by the stream. If this measure was neglected, the water would soon overflow the top of the dam, and wear it away gradually.

SECT. V.

By using the above precautions, part of a work, or indeed any post situated near a stream, may easily be secured: but if the question was to cover the whole front of a camp with an inundation, much greater pains and labour would then be required, for several dams must be made at proper distances across the brook and both sides of the adjacent ground.* The distance at which these dams

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* Several dams are to be constructed, not only when you wish to cover the whole front of a camp by an inundation, but when you apprehend a single one may be carried off by the current, or that it may be destroyed by the enemy's cannon.

are constructed depends entirely upon the nature of the current: if very rapid they must be raised at every hundred paces; if, on the contrary, smooth and gentle, at a much farther distance.

The space between two parallel dams is called a coffre. When you are to construct them, you must always begin towards the head of the stream, and continue downwards. (Vide Plate 37.) The numbers indicate the order in which they are properly constructed. For, if you began at the mouth of the stream, and proceeded upwards, it is obvious that the work would soon be interrupted, as, after the first dam being completed, the flowing back of the water would render it impossible to carry on the second, and so on with regard to the rest. In short, all these coffres must be filled with water, one after another, in the order in which the stream runs, till the whole front of the camp is covered by the inundation. Che-

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cannon. The dams nearest to the source of the brook are to be less elevated than those which are more distant from it, the fall of the water being less in the former case than in the latter.—TRANSLATOR.

vaux-de-frise, trees, branches, &c. will render the dams impassable: they must also be defended by some small detached works, which will prevent the enemy from passing them in the night, or cutting them to let off the water.

CHAPTER XI.

Of the Construction of Fougasses.

A WORK is rendered stronger and more respectable by constructing small mines, otherwise fougasses, before the weakest parts, and generally those that are most exposed to an attack, such as the salient-angles, and the faces that are not defended by a cross-fire. These mines, notwithstanding their utility, are constructed within a very short time: and although the enemy should have already advanced within a few paces of a work, yet that is no reason why they should be considered in the least nearer to render themselves masters of it: as, on springing the mines, they are instantly blown up, which occasions, besides the loss of men, the utmost confusion amongst the survivors, the assailants in general having

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not the least suspicion of what is prepared for them.*

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* Fougasses, no doubt, are an excellent mode of defence, not so much on account of the loss of men which the enemy sustain, and which never is very considerable, but because they are thrown into disorder and confusion. Soldiers in general are fearful of mines, and do not readily advance towards such points where they suppose some have been constructed. In order to render this mode of defence still more effectual, I shall always recommend, if time and circumstances will permit, to have several rows of fougasses; for if there is but one, they no sooner have had their effect, than the enemy, thinking they have nothing more to fear, advance towards the intrenchment with better spirits; and even though they should suspect there are others, they would march with much more rapidity to the ditch, where they know they are less exposed: so that the advantage produced by the fougasses would be of less consequence: but if a second explosion takes place the enemy then think the whole ground has been mined, their disorder will increase in proportion, and if at the same moment a column of attack marches on their flanks, by means of the openings that have been left in the intrenchment and near the fougasses, such a sally conducted with spirit and promptitude will unquestionably have its full effect.

But whether one or several rows of fougasses are used, the effect will be made more certain by the addition of trous de-loup, which will impede the enemy's rapid progress over the space of ground which these former occupy. In the first case I would place them behind the fougasses, and at the distance where the funnel terminates. In the

Every officer should know how to construct these mines; for it may frequently happen that there should be no engineers at hand: and though it be not his province to be proficient in the whole art of mining, which requires the knowledge of extensive and intricate details, yet he cannot dispense being well acquainted with every particular relating to the construction of fougasses. He will derive sufficient instruction from the following rules.

SECT. I.

A pit, or shaft, three feet square, and six, seven, or eight feet deep, is dug, at ten, twelve, or even fourteen feet distance from the ditch of a work.* If the earth is not of a firm nature,

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second case I would place them between two rows of fougasses, and at the same distance as above. The auget may be conducted through the trous-de-loup, the same as is done across the ditch, which will be explained hereafter.—TRANSLATOR.

* The fougasses may even be placed at a greater distance from the edge of the ditch, especially if there are several rows of them, and if trous-de-loup have been added. The only inconveniency attending is the lengthening of the auget and saucisson.—TRANSLATOR.

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the sides are supported with boards or planks, in the same manner as practised in metallic mines, three feet long, having a small piece about an inch broad sawed out at each end, and half as wide as the plank. (Vide Plate 38, fig. 1.) When the earth is dug out, at the depth of two feet, four of these boards put together form a kind of frame, (vide fig. 2.) which is placed inside of the shaft, just below the surface of the ground, and so on progressively as it is made deeper, to prevent the earth falling in. If the soil is light and sandy, the frames must be applied close together; but if not, they may be placed only at the distance of one foot. When in clay, all this trouble becomes unnecessary, for no other supporting is requisite except the first frame, nearly on a level with the surface, and even this is required only to prevent the workmen on the edge breaking down the earth accidentally.

SECT. II.

When the shaft is dug sufficiently deep and properly supported, a square hole is to be made at the bottom, on that side next the work, to lodge the box of powder. This hole

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is called the chamber of the mine, and is also propped up with boards, or pieces of wood. The height and breadth of the chamber are in proportion to the box holding the powder; but the trouble of measuring will be saved when it is known that it should be exactly a cube, and the side of it one sixth part of the depth of the pit; if this, for instance, is six feet deep, the chamber must be a cube of one foot, and so on in proportion.

SECT. III.

It is necessary to ascertain the exact depth of the mine, also the nature of the soil, to determine the proper quantity of powder to be used. The most general depth of a mine is six, seven, or eight feet; but the annexed table of Mr. de Vauban will determine at once the necessary quantity, in proportion to the nature of the soil.

TABLE

TABLE.

Depth of the Mine.	Ordinary Ground.		Sandy Ground.		Mixed Ground.		Clay.		Stony Ground.	
	Pounds.	½ Ounces	Pounds.	½ Ounces	Pounds.	½ Ounces	Pounds.	½ Ounces	Pounds.	½ Ounces
A Mine of 6 ft. deep,	14	25	17	28	18	31	20	—	23	4
7 – requires	22	5	26	8	26	11	27	14	31	20
8 –	34	13	42	6	44	10	46	13	52	18
9 –	55	18	67	16	71	20	75	26	88	—
10 –	78	18	96	4	100	20	106	8	121	28
11 –	104	24	125	22	132	24	139	26	163	—
12 –	132	20	161	4	170	24	180	8	208	28

The dimensions of the box are determined by the quantity of powder to be used: but there is a general rule also to be observed, viz. that the inside of the box must be a cube, whose side is exactly the ninth part of the depth of the shaft. If this, for instance, is six feet, or seventy-two inches deep, the inside of the box must be eight inches square every way. The cover is not to be made fast to the box. At about an inch from the bottom, a hole, an inch and a half square, is cut in the side of the box, to admit a small wooden tube (vide Plate 38, fig. 3), which is intended to conduct the fire to the powder. Although it appears but about an inch on the outside, yet it reaches quite to the middle of the box within,

within, by which means the powder is kindled from the center, and thus produces the best effect.

If there should be any particular reason to imagine that the powder will remain long in the chamber of the mine before it is fired, it will be necessary, particularly in a moist soil, or where there are springs, to pitch well over all the joints of the box, or line it with straw woven together, and to wrap it up either in straw, mats, or wax-cloth, to preserve the powder from getting damp. If there should not be time enough, or that circumstances would not permit to procure a box of this kind, some other contrivance must be recurred to: a bucket, a corn cribble, a small basket, or any other implement of that kind, will do nearly as well, provided the above-mentioned tube can be applied. The box being filled with powder, and the cover laid upon it, it is placed in the chamber of the mine, which it must fit exactly, without projecting into the shaft. At the same time, great care must be taken that it does not move in the chamber; and if this latter should be either too high or too wide, the vacancies must be filled up with sod, or pieces of wood. A board three feet long is

then

then placed before the box, so that it is entirely shut up in the chamber: but at the bottom of the board, a hole three inches square must first be cut out, through which the wooden tube is to be introduced. (Vide Plate 38, fig. 4.)

SECT. V.

To fire the mine, a saucisson is used, which is a long pipe in form of a sausage, made of coarse cloth or fustian, sewed length-wise, and about two inches diameter. As it is necessary it should be well crammed, near half a pound of powder is allowed to every foot it measures. This train reaches from the chamber to the place within the redoubt where it is fired, and which is called the focus.* To prevent this saucisson from getting damp, it is laid in a long wooden trough, called *auget*, made of boards three inches and a half broad, and joined together length-wise. (Vide fig. 5.) A part of this auget, two feet shorter than the shaft is deep, is then placed perpendicularly in it, in such a manner that the lower end communi-

* The author calls focus the place within the work where the saucisson is to be set fire to; but in mines the focus is generally understood to be the center of the chamber.—TRANSLATOR.

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cates with the wooden tube fixed in the box of powder. Sometimes it is nailed to the frames which support the sides of the shaft. From the pit to the ditch of the work a small channel, two feet deep, is next made, and the auget laid along in it, nailed to the part set upright. From thence it is continued across the ditch quite to the parapet, which it likewise passes, an opening being cut for that purpose, as far as the focus *a*. (Vide fig. 6.) The lower end of the saucisson is then tied with a piece of packthread to the above-mentioned wooden tube, which communicates with the powder, and is laid all along the auget quite to the *focus* within the work: it must be fastened to the sides, at every half foot, with small nails driven with a wooden hammer. The lip of the auget is then fastened with wooden pegs, the channel cut for it filled up, and the parapet repaired. The auget must be supported with two or three pickets *b*, driven well into the ground to which it is nailed, at that part where it crosses the ditch: as it is there on a level with the ground, and liable to be moved, stones are laid over the end of it within side: it may also be secured with cross-pickets driven in obliquely.

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Such is the method of proceeding when there is not time enough to use other measures; but if the contrary should be the case, the auget then, instead of crossing the ditch, should pass underneath it, every where two feet below the surface. When, on account of the soil being moist, or that there is reason to imagine the mine will not soon be sprung, the joints of the auget then should be well pitched within. If, on the contrary, the soil is dry, the auget becomes useless; some dry straw wrapped, four or five inches thick, round the saucisson will be quite sufficient.

SECT. VI.

When every precaution relative to the auget and saucisson has been attended to, three or four pieces of wood, about three inches thick, and three feet two inches long, are placed against the board which is placed before the box that holds the powder, two others of the same dimensions against the upright part of the auget, and then the shaft firmly filled up with earth.

Two carpenters, assisted by four men provided with pickaxes, may easily complete such

a fougasse

a fougasse within six or seven hours, if they have all the necessary materials in readiness.

SECT. VII.

The *focus*, or end of the saucisson, where the mine is fired, must be eight or nine paces from the parapet, and great care must be taken that it neither catches fire accidentally, nor gets injured by damp. That end of the auget near the *focus* must be six inches longer than the saucisson, in order to preserve it from the rain. Six inches of the cover must be cut off, and laid on loosely, so that, when the mine is to be sprung, it may easily be removed. A certain quantity of powder, bruised or ordinary, should be in readiness when the enemy begin their attack, to strew over the end of the saucisson: the small piece of the cover that has been cut off must be previously removed of course, and match applied the moment the enemy reach the spot where the mine has been dug.

SECT. VIII.

If a mine is well constructed and properly charged, the moment it is fired it will form an excavation, called an *entonnoir*, or funnel, which resembles an inverted cone, or sugar-loaf; and its

its diameter at the top will be exactly twice the depth of the shaft: so that if this latter, for instance, be six feet deep, the diameter of the funnel will be twelve: if ten feet deep, the diameter then will be twenty; and diminish or increase in the same proportion. (Vide Plate 39, fig. 1 and 2.)

SECT. IX.

It may happen that several fougasses are constructed in front of a work; but in this case it is not necessary that each of them should have a particular focus, for one may be quite sufficient for three or four mines, nay, even for more. If they are not to go off together, and at the same time, an auget must be laid from each, two feet below the surface, within two feet of the ditch, almost meeting in a point, from whence they are continued separately across the ditch and parapet, running very near each other, quite to the focus. (Vide Plate 39, fig. 3.) Attention must be paid to make the augets of different lengths, in order that the mines go off one after another; and care must be taken, when the fire is put to one, that it does not communicate with the others. A vast deal of trouble is saved by having only one

focus to several mines, since the parapet is no longer to be cut as often through as there are augets for the reception of the several saucissons.

SECT. X.

If several mines are intended to be sprung at once, a point must be found, some feet from the ditch, at an equal distance from all the different chambers. (Vide Plate 39, fig. 4.) Then an auget with a saucisson is laid from each to this point, the ends joined, and one single auget and saucisson continued across the ditch and parapet to the *focus*: by this means the mines must all go off together as soon as the match is applied to the focus. Care, however, must be taken to have the shafts so far asunder, that the effect of one does not interfere with that of another; or, in other words, that the funnels formed by the explosion do not cross. If they are made double their depth asunder, this accident will never take place.

SECT. XI.

Mines of these kinds may be constructed, and disposed to great advantage, in a triangular form, called *en trefle*, before the salient angles of

of a work. (Vide Plate 39, fig. 5.) That they may be sprung together, a point is found, as above mentioned, equally distant from the three chambers, and which is called the center of the chambers. An auget with a saucisson is then laid from each mine to this point, and next one single auget is continued across the ditch and parapet, as before said, Sect. x.

SECT. XII.

When circumstances make it necessary to abandon a redoubt, or any other work of that kind (though newly erected), and which, if left undestroyed, might be of advantage to the enemy, mines then must be constructed to blow up the parapet, as soon as the last of the garrison have quitted it. It may likewise happen that a tête-de-pont is to be thrown up, merely to cover the retreat of a corps, and which, from the first, is only intended as a temporary work; in those cases, before the work is begun, shafts from five to seven feet deep are to be dug, exactly under where the parapet, and principally its angles are to come, that it may be blown up the moment the rear-guard have crossed the river. If you add the height of the parapet to the depth of the shaft, you shall

know what quantity of powder such mines will require: if, for instance, the shaft is five feet deep, and the parapet six feet high, the same charge will be required as for a mine eleven feet deep. The *focus* of these mines is always in the center of the work, and the saucisson laid in an auget. (Vide Plate 39, fig. 6.)

CHAPTER XII.

Attack and Defence of Field-works.

(SUPPLEMENT.)

SECT. I.

PREVIOUS to fixing the general rules to be observed in the attack and defence of field-works, I shall successively review, and reply to the objections that have been made with respect to intrenchments, properly so called.

I shall, in the first instance, distinguish three kinds of intrenchments: first, those constructed by an army very inferior in number to the enemy, and which, on this account, is obliged to keep solely on the defensive; in the next place, those which may be erected by an army,

which,

which, though indeed inferior in number to the enemy, is however not so weak as to be totally unable to act offensively, according to circumstances, and has no other view in intrenching itself than to counterbalance the superiority of the enemy by some few works. Lastly, the intrenchments which embracing a great extent of ground, and which are most commonly denominated *lines*,* are intended to cover a whole country, to protect it from contributions, &c.

Intrenchments, say some military men, *give the troops an idea of their weakness, and of the danger to which they are exposed; and the sensible idea of danger, together with the inward conviction of his weakness, intimidates even the brave man.*

I readily admit the truth of the second part of this objection, at least generally speaking; as to the first, I shall observe, that the weakness of an army is always caused either by the losses it has sustained by desertion, disease, the fire of the enemy, or, lastly, by the want of sufficient reinforcements to compensate those

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* The word *lines* is likewise applied to the other kinds of intrenchments.

losses. Whatever precautions may be employed to dissemble their extent, whatever care may be taken to exaggerate the strength of the reinforcements that may have been received, and to depreciate the force of the enemy, the soldier will always know very nearly the real state of things, and it will not be the intrenchments that will communicate to him the idea of his weakness, nor of the danger to which he is exposed. I think, on the contrary, that they will weaken that idea, because the soldier measures with his eye the extent of the obstacles opposed by the intrenchments to the enemy. These he even exaggerates in his imagination; and what proves that he expects from the intrenchments considerable protection is, that he works at them with great activity, as many military men besides myself may have observed; and this he would not do, if he did not imagine that they contribute materially to his personal safety.

Can there, moreover, be any thing more reasonable than to endeavour to supply, by the resources of art, the deficiency of natural advantages in a defensive position which you are obliged to take? And so far from being a discouraging testimony of our weakness, we ought

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to consider a fortification as a remedy calculated to repair it. "The pike and the pick-axe," says Folard, "are the resource of the weak, or of those who are resolved to risk nothing; they are the only weapons with which they defend themselves, and which are the most proper for preventing the effect of the others."

It is likewise objected, *that an intrenched army, being unable to leave its intrenchments but in files, is cramped in its movements; while, on the contrary, the enemy who approaches them is at liberty to move and manœuvre as he thinks proper.*

I acknowledge, in some measure, the justice of this assertion, I say, in some measure; for if care has been taken to have a sufficient number of entrances, you will preserve the means of making sorties, which will always deprive the enemy of the possibility of manœuvring as he shall think proper, at least, when he has approached the intrenchments. Besides, I always suppose here, that the weakness of the army obliges it to keep solely on the defensive; therefore, its object is not then to make great movements, but partial sorties, in order to maintain itself in its

intrenchments, and by all means to avoid a battle, which in the weak state of the army would be too unequal.

If we pass to the second kind of intrenchments, I must confess I should prefer them to be composed of single or unconnected works, the number and strength of which should be determined by the greater or less inferiority of the intrenched army, as well as by the nature of the ground: the second objection would then be done away, and as I have already observed, it would doubtless be a great advantage, to be able to prevent the enemy from penetrating the intervals, till he has made himself master of these works, which, without this, would batter him in flank.

With regard to the last kind of intrenchments, they, in general, have the disadvantage of requiring a very extensive space, and consequently a great number of men to defend them, which must necessarily weaken the army. It is besides very difficult to render them equally strong in every point, and if there be some weak parts, they will, as I have observed in the chapter of maxims, render useless the strength of the others, since the enemy will not fail to direct his attack against

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the weak parts. I shall, however, observe, that there are favourable situations, where the ground enables you to reduce the points of attack, so that those inconveniences are obviated; but as these situations are extremely rare, this kind of lines must be so likewise. For the rest, I acknowledge that intrenchments, be they of whatever kind they may, raised in a dry, level, and open situation, such as an extensive plain, are much more dangerous than useful, whenever they are of greater extent than the front occupied by the army, drawn up in order of battle.

Lastly, whatever may be the nature of the intrenchments, and the object they are intended to accomplish, it is necessary, as I have observed in the chapter of maxims, that their flanks should be perfectly secure; that they should be equally strong in every point; that they should not occupy a more extensive space than can be properly defended; that they should not be commanded in any point from without; that, finally, they should not cramp the movements which the army, according to its particular state, is capable of making, which has been explained in the preceding paragraphs. I should not hesitate to assert

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the utility of intrenchments combining these qualities.

SECT. II.

Project of attack.

You may make yourself master of any intrenched post, either by surprise, or by attack; but whichever method may be employed, it is always necessary to possess a perfect knowledge of the nature of the works, of their condition, and of the ground adjacent to them. To obtain this knowledge, the commander of the army, and some engineers, approach as near as possible to the works, supported by a body of troops, whose strength depends on circumstances.

These officers attentively examine the extent of the works; their nature; the manner in which their lines flank each other; if they are not commanded in front or flank; if the points which command them are occupied or not by the enemy; if they are not covered entirely, or in part, by an inundation; the apparent extent and depth of this inundation; if there is not some position from which the dams

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may be cannonaded and destroyed; the number of the dams; if they are covered, and their passages obstructed by any detached works. They likewise examine in what manner the flanks of the intrenchments are covered; if it is not possible to turn, or attack them in flank, or rear; which are the most favourable situations for the erection of batteries, either to enfilade the branches, or to batter in breach; if the enemy has not neglected to obstruct all the roads; if there are not some ravines, or other objects, under the cover of which the troops might advance, without being perceived. And here I should observe, that the general must have the most accurate and detailed account possible, relative to those things which it is of importance that he should be acquainted with, in order to determine with propriety upon his plan of attack.

Some information may likewise be obtained from the prisoners, deserters, and spies, who having been able to approach quite close to the works, have had an opportunity of observing whether the ditches are wide and deep, and if there are palisades, &c; but their reports ought to be relied on only to a certain degree, and they should likewise be compared, to see whether

whether they correspond, for without this precaution you would frequently run the risk of being deceived.

It must likewise be observed, that the greater or less strength of a front of fortification, does not always depend on that of the works of which it is composed, but on the adjacent ground from which it sometimes receives the greatest part of that strength.

SECT. III.

Surprise.

The measures of prudence and the precautions to be taken to approach an intrenched post without being perceived, being the same as those that are to be observed when you wish to surprise the enemy in any post whatever, I shall not enter into any particular detail on this subject. I shall likewise omit to treat of stratagems, by which an enterprise of this kind may be made to succeed the more easily, since these matters have only a general connection with the present subject, and every military man ought to be acquainted with them.

I shall only observe that whatever the post may

may be, which you wish to surprise, if you have been so fortunate as to approach it unperceived, as soon as you have arrived at the ditch, you must pass it and mount the parapet, without loss of time, for if you delay ever so little and the alarm be once given, the enemy may have time to make proper dispositions to repel you, by which the success of the enterprise may be rendered extremely doubtful.

It is advantageous, when practicable, to surprise works by the gorges. I shall likewise observe, that whether you wish to surprise a field-work, or an intrenchment of more considerable extent, you must, (paying, however, due regard to the ground, the nature of the works and circumstances,) endeavour to do it at the same instant in the greatest possible number of points. This attention is particularly necessary in the surprise of intrenchments of any extent, in order that by taking advantage of the darkness and the confusion that will prevail among the enemy, you may prevent them from gaining a knowledge of your dispositions, and from sending relief to those places that actually stand in need of it.

The entrances of intrenchments being in general better guarded than the other parts, it

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is advisable that the first troops who shall scale, be at some distance from them; and if upon their approach the enemy has fled, those who are nearest to the entrances, must push rapidly towards them, attack with the bayonet all who still make any resistance there, and thus favour the passage of columns which must previously have been directed towards the entrances. These troops will execute this movement without danger, since, from the surprise of the enemy, there is no reason to apprehend that he will dispatch fresh troops in time to attack them. But if on the contrary the enemy remain firm, these first troops must fire upon them from the top of the parapet, and not push forward till they can be sufficiently supported.

The different columns should be accompanied by men carrying fascines, pioneers and carpenters to fill up the ditches and trous-de-loup, destroy the palisades and chevaux-de-frise, throw down the parapets, and make large apertures to accelerate the entrance of the army. All these things ought to be executed in the most speedy manner possible, as the success of such enterprises most frequently depends on promptitude. It has been proposed to make

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the front rank of the first division of each column carry the fascines, but I must confess that this method appears to me to be attended with many inconveniencies, and I think that, in general, the soldier cannot be too free in his movements, particularly when he is marching against an enemy.

As soon as a sufficient number of columns and of cavalry have penetrated into the intrenchments, they ought, without loss of time, to form in good order, and briskly attack the enemy, in order to profit by his consternation, and not give him time to recover himself. In these cases the cavalry, in particular, will produce a great effect.

If the post which you wish to surprise be a fort, a redoubt, or any work near a village where you know that the greatest part of the garrison is posted; or if this post be a village situated in a chain of cantonments, you must, if possible, bring a body of troops between the post and the points whence it may be relieved, in order to cut off the retreat of the garrison, and prevent them from receiving assistance. Sometimes this manœuvre is sufficient to oblige them to surrender.

It is of the utmost consequence that the

march of the columns, when approaching the intrenchments, be conducted by persons who possess a perfect knowledge of the country. For if one only were to mistake the way, this would be sufficient to derange the whole plan and frustrate the enterprise.

SECT. IV.

Attack.

I have hitherto comprised every kind of fortified ground, under the general denomination of intrenched posts. The manner of attacking and defending them, however, varies to a certain degree according to the nature and extent of the posts, and of the works by which they are protected. I shall, therefore, first state the rules generally established for the attack and defence of intrenched camps, and which are, for the most part, applicable to other kinds of posts; and then examine which of them are peculiar to certain species of posts and works.

I must previously observe, that the opinions of military men vary with regard to the most favourable time of attack. Some maintain, that it is advisable to commence it an hour or two before day-light, because the enemy cannot

not then distinguish the false from the real attacks, nor our order of battle; that besides, our soldiers have less to fear from his fire; and lastly, that the day breaking upon us immediately after scaling the parapets, we shall then be able to see every thing, and to take the necessary measures for pursuing the enemy.

Others object, that an attack by night is attended with many disadvantages; in the first place, with the difficulty of maintaining among the troops, that order which operations of this nature require; in the next, with that of keeping an eye upon the conduct of the soldier, who not always possessing that innate valour which manifests itself even when unobserved, stands in need of a stimulus like pride or ambition; so that, as his conduct cannot be noticed, as in an attack by day-light, it may perhaps not be equally commendable. To these different objections I reply, that all of them are equally plausible, but that without exclusively adopting either method, circumstances alone should guide the general in his determination on this point.

The same variety of opinions prevails, relative to the distance at which real attacks should be made from each other. On this head, I shall

observe, that the distance must depend on the ground, the nature and relative disposition of the works, and lastly, on particular circumstances which must govern the decision of the general on this subject.

SECT. V.

Attack of intrenched camps by day.

If the attack upon an intrenched camp be made by day, the assault ought to be preceded by a heavy cannonade, by means of which you endeavour, if not to dislodge the enemy entirely from the works, at least to occasion him to lose a considerable number of men, to silence part of his artillery, and to break down the parapet in several places.

As soon as the number and the places of the real or false attacks are determined, and you are at proper distance from the post, the artillery takes those positions which are suitable to it, relatively to the object to be accomplished. Batteries which are composed of cannons and howitzers, are placed perpendicularly to the prolongment of the several branches of the works, in order to enfilade them, and batter in flank the enemy's artillery, and the troops which

man

man the parapets; others are placed facing these same branches or the curtains, to break down the parapets and fire through the enemy's embrasures. If, in the front of the post, there should be an eminence commanding it within cannon-shot, and which the enemy has not occupied, you ought to take possession of it and there erect strong batteries, which will not fail to be of great service. Others must likewise be erected against the entrances, when they are spacious or not sufficiently covered, and when for that reason you are able to batter them in echarpe. Lastly, great numbers of shells should be thrown from howitzers into the redoubts, and generally into the enclosed works included within the intrenchments, where they will do much mischief.

As soon as the artillery has executed its object, the columns destined for the attack must put themselves in motion, observing to threaten every point at the same time, and to conceal as much as possible the columns which are intended to make the most powerful attack. In this manner the enemy are obliged to man equally all their lines, and are prevented from bringing up their reserves, or reinforcing those points where real attacks are to be made. This

is not easy in a level open country, where all that you can do is to mask the columns by other troops, which is frequently insufficient to prevent their being perceived; but the ground may be such, that there is an eminence, hedges and hollow roads, by favour of which you may conceal the storming party, which should not advance till the false attacks have commenced, and the enemy is already engaged.

It is unnecessary to observe, that if the attack be made in the night, the above-mentioned cannonade cannot take place, and that you must proceed to a direct assault as soon as you have approached the intrenchments.

There are likewise circumstances, in which, though attacking by day intrenched posts in general, that cannonade may be dispensed with; as for instance, if you are about to attack works of little importance, or others which you know to be badly guarded or insufficiently defended. It would be a case of the same nature, if you wanted to obtain possession of any post which might in a short time be relieved without its being in your power to prevent the arrival of assistance. Such too would be that where, for important reasons, you are

obliged

obliged speedily, and cost what it will, to take possession of a post. But such a mode of attack, particularly in the two last cases, generally occasions a great loss of men, and always presupposes a great superiority either in number or in tactics on the part of the assailant.

SECT. VI.

Order of battle.

It is still a point of dispute among many military men, whether intrenched posts ought to be attacked by troops formed in column or deployed. To the first mode of attack, it is objected that it exposes the troops much more to the fire of the artillery, and particularly to grape-shot. I shall, however, first observe, that besides its being more easy for columns than for deployed troops to march in order, the former will traverse the distance between them and the post much more expeditiously than the others, and will, consequently, be a less time exposed to the fire of the artillery, so that what they will lose on the one hand, they will gain on the other. In the second place, I shall observe, that as by reason of the velocity of the columns, their direction and distance from the post vary at every moment, so likewise the pointing of the cannon must be chan-

ged every moment, which would render the fire of the artillery more slow and uncertain. Add to this, that, arriving at the edge of the ditch in better order, they will be the sooner and better prepared for the assault; and lastly, that in the shock, solid bodies of that kind will possess a force of percussion much more considerable than troops, so few ranks deep, can possibly have. I therefore think the formation of troops into columns far preferable to the other.

There is likewise another question equally interesting, which I shall now proceed to examine; namely, whether the troops should fire during their march. I shall not stop to discuss the supposed advantages of this method, which is said to be employed in order to draw off the soldier's attention, and to prevent him from reflecting on the danger to which he is exposed, from perceiving the number of killed and wounded around him, and from hearing their cries and groans, which might make an unfavorable impression on his mind; and lastly, to disturb the enemy, whose fire would take much more effect, if he were left tranquil and had nothing to fear from us, &c. To these feeble arguments I will briefly reply, that the attention

tion of the soldier will be much more effectually drawn off, that he will take much less notice of the killed and wounded, that he will hear much less of their cries and groans, when, hurried along by the rapid march of the columns, he traverses in an instant the space which separates him from the post; I will add moreover, that this rapid, audacious and uninterrupted march of the columns, together with the force they present, will strike much greater terror into the enemy, and will derange the accuracy of his aim much more than could be done by a fire of no consequence, and whose least disadvantage is that of wantonly wasting valuable ammunition.

Concerning this method, I must still observe that it keeps the troops longer exposed to the fire of the post, by necessarily slackening their march. It is, in fact, impossible that the soldier should load, fire and march without stopping; but supposing this could be done, it must, at any rate, be admitted that a fire of this kind is extremely uncertain, chiefly because it is directed against men whose heads can scarcely be seen, at least in those parts the parapets of which have sustained no particular injury from the cannonade. Add to this, these con-

tinual halts of the troops on the march, necessarily occasion a constant fluctuation, which prevents them from arriving in order on the edge of the ditch. They likewise render them liable to remain much longer than they ought at those points where the destructive effects of cross fires are felt.

These considerations must convince every one, that the method of firing while marching is faulty in every respect; that it gives the enemy, to whose view you are completely exposed, all the advantage of his situation behind a parapet which covers him; that, in a word, it ought to be entirely exploded.

I have, however, no objection to place on the front and in the intervals of the columns, either light troops or volunteers from the regiments, to attack *en tirailleurs*, and who, since the partisans of the method of firing on the march desire it, would draw off the soldier's attention as they wish; and if any effect is to be hoped from the fire of a body of men on a march, it might, in a particular manner, be expected from that of these tirailleurs, whose march may be less regular than that of the columns, and who, for this reason, may stop, load, fire, &c. they must leap into the ditches

and

and mount the parapets at the same time that the columns of attack make the assault.

There are even cases in which these tirailleurs may render it unnecessary to employ such considerable columns where false attacks are made, and yet the enemy may be kept in such a state of alarm as to prevent him from withdrawing troops from those parts in order to reinforce others. I allude to those cases when the ground permits you to present only at a certain distance, heads of columns the depth of which the enemy is unable to discover, and to which it is of advantage to give an extensive front; the enemy might suspect the stratagem, he will, however, remain in an uncertainty from which he cannot relieve himself, as he dares not venture out too far in a sortie for fear of being cut off. But the employment of these means requires great prudence, for if these columns were much too weak, or placed at too great a distance, the flanks of the real attacks would then be uncovered, and fatal consequences might result from it.

Nor do I object to the covering of the storming party with deployed troops, when it can be masked by this method, (which will most frequently depend on the ground,) and thus conceal

conceal from the enemy the points where the real attacks are intended to be made; for as this is the principal object, all the secondary means, tending to the attainment of it, whatever they may be, are for this reason alone advantageous.

The columns, as in surprises, ought to be accompanied by men carrying fascines, pioneers, carpenters, &c.

As to the distribution of the troops, the columns ought to be supported, and at no great distance, by reserves, which must advance, either if the enemy make sorties, or if the columns, being repulsed, find it necessary to rally behind them; or lastly, if, in case the enemy abandon the works and betake himself to flight, it be determined to pursue him. The columns and the reserves should likewise be supported by cavalry, whose position must be determined by the ground and by circumstances.

I have hitherto supposed, that the flanks of the post were secured, in such a manner as to prevent their being turned, or any thing undertaken excepting in front. The measures necessary to be adopted under other circumstances are easy to be deduced.

SECT. VII.

Assault.

The columns ought, as I have observed, to approach the works as expeditiously as possible, that they may be exposed for a less time to the different fires proceeding from them. It will however happen when works mutually flank each other, that the fires of the flanks will pass at a small distance from the ditches, sometimes even the whole length of the latter will be exposed to their effects. It is, therefore, of the utmost importance to pass, without loss of time, over the ditch, which, for this reason, ought immediately to be filled, and every obstacle, such as palisades, fraises, and chevaux-de-frise, removed. The breaches and entrances must be attacked at the same time, in all the points of the fronts of attack; and if any sorties be made from the collateral parts, they will be received by the columns, supported by the reserves, and, if necessary, by the cavalry.

The troops that have scaled the parapet must not leap down in disorder, nor pursue the enemy if he give way, because, as he is supported by his reserves, he may take advantage of their confusion, attack them in his turn, and perhaps quickly repulse them. They ought,

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on the contrary, to form in order of battle on the top of the parapet, and wait till the pioneers have enlarged the breaches sufficiently for the army to pass through. When a sufficient force has arrived, it should form in good order, and comply with the measures which the general thinks proper to take for the pursuit of the enemy. These attacks ought always to be brisk, vigorous, and made in the best possible order. Too much pains cannot be taken to inculcate on the mind of the soldiers, that on this absolutely depends the success, and that, whatever may be the causes which for a moment throw them out of that order, such as trous-de-loup, fougasses, sorties, they ought to recover it without loss of time.

It is unnecessary to observe that the intrenchments should be attacked, if possible, before the enemy has had time to complete them.

SECT. VIII.

Attack of unconnected intrenchments.

I have hitherto supposed the camp to be covered by connected intrenchments. However, as I have before observed, either if the intrenched army wants time or materials, or if it is not very much inferior in number to the

the enemy, the intrenchments may be composed of single works, or unconnected works.

To attack a camp intrenched in this manner, it is necessary, as when the intrenchments are connected, to precede the assault by a cannonade, directed against the works, and the troops behind them. If these works be enclosed, such as redoubts, a great number of shells must be thrown into them from howitzers. All the works ought to be attacked at the same time, that the troops stationed at each being occupied with their own defence, may not think of the collateral works; and the columns should be supported by the army, which, in case the enemy advance through the intervals, to take the columns in flank, should march to meet him and cover them. When one or two of these works are carried, if circumstances permit, the others may be attacked by the gorge, if they be not enclosed, which will be the surest and most expeditious method of making yourself master of them; but this movement, rendered dangerous by the proximity of the enemy, ought always to be executed with great prudence, and if there be reason to apprehend that the enemy can take advantage of it, you had better continue the attack in front,

and

and not proceed into the intervals, before you have made yourself master of the works, which, without this precaution, would batter you in flank.

The force of the columns of attack ought of course to be determined by that of the work which each of them is intended to attack.

SECT. IX.

Attack of forts.

The rules laid down for the attack of intrenched camps, are for the most part applicable to that of field forts: that is, excepting you attempt to surprise them, the assault is in general preceded by a cannonade, the object and consequently the disposition of which are the same. As soon as the cannonade is judged to have produced sufficient effect, the columns of attack advance, conforming, in the assault, to what has been said relative to the attack of an intrenched camp. I shall here observe, that the angles being commonly the weakest parts, it is almost always advisable that the columns, in their approach, should direct their march towards these angles, following the direction of the capital. This rule is without exception, with regard to field-works, which are not flanked. I must likewise observe, that in the

attack

attack of a fort, as in that of any enclosed work, the batteries of howitzers should be as numerous as possible.

SECT. X.

Attack of têtes-de-pont.

Têtes-de-pont may be intended for three different purposes; 1st. for covering a bridge of communication; 2d. for ensuring the success of a corps, that attempts to force the passage of a river; 3d. and lastly, for facilitating the retreat of the same corps, if it be obliged to re-cross it.

If the communication, which the enemy intends to cover, be not of great importance, he will be content to construct a tête-de-pont of no very considerable force or extent, and by scaling you will soon make yourself master of it. A few cannon-shot will frequently be sufficient to dislodge the troops by which such works are defended.

But if the communication be of great importance to the enemy, it is natural to suppose that he has not only covered it by intrenchments, capable of making a vigorous defence, but that, exclusive of a sufficient garrison, he has stationed near it a body of troops. In this case it is necessary to have recourse to

a regular

a regular attack, directed according to the rules already laid down. I shall farther observe, that as it is probable the enemy's intrenchments will be flanked either by works or batteries constructed on the opposite shore, a numerous artillery is particularly necessary both to answer the fire of that shore, and to cannonade the bridge or bridges, if there be several.

Now, supposing the enemy attempt to force the passage of a river, in which case the troops forming the van-guard endeavour to erect, with all possible expedition, a work to cover them and to facilitate the construction of bridges, you should, without loss of time, attack these troops, and let it cost what it will scale the work, which the enemy may not perhaps have had time to complete. I here suppose, that the van-guard only has passed over, and has covered or is endeavouring to cover, itself. But if bridges have been thrown across, if the whole or the greatest part of the corps have passed over, it will then be necessary to have recourse to general dispositions, which have a more immediate relation to the troops, and which I cannot here examine, without digressing from my subject. I shall merely observe that as the destruction of the bridges necessarily

sarily involves that of the enemy in case he be defeated, they must be cannonaded, and if possible, destroyed during the attack, as in the preceding case.

Lastly, if a tête-de-pont be intended to facilitate the retreat of a body of troops obliged to re-cross a river; I shall first observe, that if the retreat be made in good order, if the commander of the army have taken care to seize successively every favourable position for checking the enemy, and to dispose his troops so as to enable them mutually to support each other; if, in a word, he perform every thing that is requisite in such a delicate situation, you are prevented from making any attempt on the tête-de-pont, before the troops who cover it in front, and retire by degrees, have defiled. If we, in the next place, suppose that this tête-de-pont is formed of redoubts, so disposed as mutually to protect each other, and to prevent the pursuing army from penetrating without attacking them, one after the other, and till it has forced them all; or if, conformably to the method proposed in Chap. I. section 28, the principal tête-de-pont enclose another smaller, into which some companies throw themselves in order to favour the retreat of the garrison, which, in its turn, ought likewise

to withdraw by degrees, when the army has crossed, it will be seen that the troops, occupying, by degrees, intrenchments proportioned to the diminution of their number, and which they will of course still be able to man and to defend, possess the more means of making resistance, as that resistance is to be of short duration, and that they are besides supported by the fire of the opposite shore. Every actual assault of the tête-de-pont is therefore extremely dangerous, without affording any very important advantage, even in case of success, because the utmost you can do is to take some prisoners, and to prevent parts of the bridges from being removed. You will therefore, in general, be obliged to content yourself with violently cannonading the retreating army, as well as the bridges, if possible. But if, instead of a retreat effected in good order, or a tête-de-pont constructed according to the preceding methods, we suppose the army in the utmost confusion and the works ill combined, there is no doubt but that by closely following the retreating army, and briskly and vigorously attacking it, as well as the works, you may make the most of its disorder, and perhaps destroy or oblige it to surrender.

SECT. XI.

Attack of a church-yard, castle, country-house, or small town.

Gaudi, who has explained at great length the measures to be adopted for the defence of a church-yard, a church, a castle, or country-house, has likewise sufficiently indicated the means that ought to be employed for attacking such posts without cannon; it is therefore unnecessary for me to enlarge on this subject. But if you bring artillery against them, you should keep out of the reach of musket-shot, and in that position batter in breach the walls by which they are enclosed, the tambours and projecting parts from which the post receives externally a flank defence. The enemy will soon be obliged to retreat to the buildings which form the inner posts, and if he then persist in defending them, you must knock them down with your cannon, or set fire to them, which will soon decide the business.

Even a small town, surrounded only with a simple and not very thick wall, is incapable of making a much more powerful resistance, and you may always make yourself master of it with facility either by breach or by escalade.

These posts in general are fit only to afford protection against a surprise, but are not calculated to resist an attack with cannon.

SECT. XII.

Attack of an intrenched village.

If the village be situated on the front of an army whose position it flanks, or on one of its flanks, a resistance so much the more obstinate must be expected, as, independent of the importance of the post to the enemy and the strength of the works, with which he will, in consequence, have covered it, the garrison, in case of attack, will not fail to be powerfully supported. You must therefore proceed to a regular attack, conforming in this attack to the rules already established for that of intrenched camps.

To facilitate the success of this attack, it is necessary at the same time to cannonade the works and to throw into the village a great quantity of shells from howitzers, in order to set it on fire. It is possible indeed, that by these means you may not oblige the enemy to abandon the works entirely, especially if he has taken care to construct them at a sufficient distance from the houses, so as not to be incommoded

commoded by the heat; but you will always obtain this advantage, that if the intrenchments are forced, the enemy cannot without difficulty make good his retreat through the flames, nor will he be able to throw himself into the houses to fire upon you. It may likewise cut off in some degree his communication with the army, and impede the movements of the troops that may be coming to his relief.

If the village be situated in the front of the army, the attack ought to be carried on against the front only; for if you were to attack it on all sides, you would not only be opposed by the garrison of the village, but would be taken in flank and rear by the army. If, on the contrary, the village be situated on one of the wings, you ought to attack more than one side at a time, in order the more to divide the forces and the attention of the enemy.

If you succeed in forcing the intrenchments, and the enemy still seems inclined to make some resistance in the village, he should be charged with vigour and driven out of it; but as there is reason to presume that he will return with fresh troops to recover the post if possible, instead of pursuing him too eagerly, you should immediately form in order of bat-

tle, on the other side of the village, and make the most advantageous dispositions for giving him a warm reception. But if, in spite of these dispositions, he oblige you to evacuate the village, you ought to make another attack with fresh troops.

If the village you are attacking be in a chain of cantonments, as it is probable that it will be assisted by the neighbouring quarters, you ought, as I have already said when treating of surprises, to station between it and these quarters, a body of troops to cut off the retreat of the garrison and prevent the arrival of succours. It is likewise a very good method, when you purpose to attack a village thus situated, to make at the same instant, a false attack on the adjacent quarters, in order to divide the attention of the enemy and prevent his sending assistance.

CHAPTER XIII.

Defence of Field-Works.

(SUPPLEMENT.)

SECT. I.

HAVING examined the general rules to be observed in the attack of field-works, I shall now

now proceed to those which relate to their defence. But I must, in the very first place, observe that, however well combined may be the disposition of the works, whatever attention may be paid to their construction, and whatever may be the nature and the number of the obstacles employed to increase their strength; the enemy will make himself master of them, if the fortitude, the *sang froid*, and, above all, the good order of the troops do not contribute to make you derive from such works those advantages, which are expected of them. It cannot, therefore, be too strongly recommended to the soldier never to depart from this line of conduct. To prevent that discouragement and terror which he often experiences, when the enemy has obtained possession of the summits of the parapets, or is beginning to enter at the breaches, and which is most frequently the real cause of the loss of intrenchments, it ought to be observed to him, that the parapets, the ditches, and every obstacle opposed to the enemy, have no other object than to keep him the longer exposed to our fire, and to cover us from his; that though it is not considered impossible for him to pass them, yet he cannot do it without experiencing considerable loss, and

being thrown into great confusion, which will then give us the greatest advantages over him. For we not only have to oppose to him our good order, our bayonets, and a close fire of our small arms, by which it is evident that he must be tumbled into the ditch, but we can attack him in flank by sorties; and even supposing that some of his troops should have entered our lines, we have reserves, who being fresh and attacking him in good order, cannot fail, in the state of confusion in which he then is, to repulse him. Such is the light in which I should wish soldiers to regard intrenchments, and I think it very impolitic to inspire them with too great confidence in the parapets, ditches, &c.; for if the enemy should pass them, the soldier, giving up every thing for lost, ceases to defend himself, as he could do with great advantage, and on that very account, every thing is really lost.

SECT. II.

Precautions to be taken to prevent the enemy from becoming acquainted with your situation.

In order to prevent the enemy from gaining a knowledge of your situation, a great number of light troops should make constant incursions

sions every where in front of your intrenchments, and push as far as prudence will permit; by this means you will impede his general officers and engineers in their attempt to approach your works, and to reconnoitre them. In the neighbouring villages must likewise be stationed some of these light troops, who must fall back to the intrenchments if the enemy appear in superior force. In treating of the project of attack, I have said, that some advantage might frequently be derived from the reports of spies and deserters, in obtaining a more perfect knowledge of the intrenchments you intend to attack; to deprive the enemy of this advantage, you should not permit any stranger, or even your own soldiers, to approach the works, and each soldier ought to know only that part of the intrenchment which is to be his post in case of attack.

In a word, all possible means must be employed to conceal your situation from the enemy, which will render it the more difficult for him to form his project of attack.

SECT. III.

Means for discovering the designs of the enemy.

As it is advantageous to you to keep from the

the enemy's knowledge every particular relative to your situation, and by which he may be directed in the formation of his project of attack, so you must by all means endeavour to discover his designs. This attention is rendered particularly necessary when your intrenchments have the great fault of occupying too great an extent in proportion to the troops you are able to employ in their defence.

It is not always easy to penetrate the designs of the enemy, for with whatever vigilance you may observe his dispositions and his movements, in order to deduce from them the probable consequences, he will deceive you by false manœuvres; you cannot, therefore, be too attentive to watch him continually, and especially to place, in case of attack, your reserves and your cavalry in such a manner that they may give support with ease and expedition to every part of your intrenchments.

Sometimes the situation of the post, the nature of the works and of the country will be of great assistance to you in determining upon the necessary dispositions. For if they reduce and fix the points of attack, your attention will be less divided, and you may concentrate the more your means of defence.

SECT. IV.

Surprise.

Nothing produces such consternation and confusion in any post whatever, nothing facilitates so much to the enemy the means of making himself master of them, as a surprise, the consequences of which are incalculable, not only for the loss of the post, but, if it be of importance, for the safety of the army, and sometimes for the issue of a campaign, or even of a war. Too great care, therefore, cannot be taken to prevent it. Gaudi having sufficiently explained the means of effecting this, and these means belonging, besides, to the general order of the service, it is unnecessary for me to enter into more particular details on this head; I shall only say, that in these critical cases, and which would not occur if the service were regularly conducted, you ought to resist the enemy as long as possible, especially when you entertain hopes of being supported.

SECT. V.

Defence of an intrenched camp.

I shall here observe the order which I have followed

followed in the attack, that is, I shall first state the rules most generally adopted for the defence of an intrenched camp, and which are for the most part applicable to the other kinds of posts; I shall then observe the peculiarities belonging to the latter.

SECT. VI.

Distribution of troops in case of attack.

As soon as you are informed that the enemy is in motion, and that his columns are advancing to the attack, the troops must repair to the different posts which they are to occupy in the intrenchments, the parapets of which are lined with infantry formed two deep. At the same time, at the distance of 20 or 25 toises behind the works, place the reserves, who in case of necessity must advance to support the troops which defend them, or to make sorties. Lastly, behind these reserves place the cavalry,*

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* Works, called *epaulements*, were formerly used to cover the cavalry; not that they were employed indiscriminately in every kind of intrenched camps, nor in their whole extent, but at least in those that were to continue for any length of time, and were made at leisure. They were most commonly placed in the parts liable to be commanded from without,

which must, in like manner, repair to any quarter where its assistance and co-operation may be required.

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without, and sometimes in those which, though not commanded, were not covered by parapets of sufficient thickness to protect them from the fire of the enemy.

The use of these epaulements has been relinquished, without any reason being assigned; probably because they were thought to obstruct the space between the lines and the camp, or because they required additional labour, with which it was chosen to dispense. It must, however, be admitted, that in many respects they were extremely useful; indeed, in whatever manner the infantry may be disposed, the parapet at a very short distance from which those troops are stationed, must be either very low or extremely slight not to cover them, at least in part; so that the cavalry, which being posted at a greater distance from the parapet, is not covered by it, at least in many cases, and behind which the infantry, that is always engaged previously to the cavalry, is to rally in case of necessity, is exposed singly, and to no purpose, to the violence of the enemy's fire. Moreover, these epaulements being, as I have said, almost always placed in the situations that were least covered, possessed the advantage (supposing a proportionate cavalry) of covering part of the camp in the front and sometimes in the reverse.

To these epaulements, which were nothing more than ordinary parapets without any slope at the top, Vauban gave the length of 40 toises, the thickness of 9 or 10 feet, and the same for the height. He placed them at an equal distance from the camp and the intrenchment, and about 50 or 60 toises from each other.

Clairac,

To avoid all kind of confusion, particularly in an attack by night, and to prevent delay in the movement of the troops, each of the brigades, composed by the reserves, should know

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Clairac, who declares himself in favour of them, and seems to insinuate that their use might be resumed, proposes to render them still more serviceable by constructing a banquette in their ditch, and raising their counterscarp about two feet, in the form of a parapet level at the top, that the fire of the infantry placed there may be parallel to the horizon, and consequently grazing.

He likewise proposes, in intrenchments that are of little extent in proportion to the quantity of infantry you have at your disposal, to erect a banquette behind the epaulement, and then to give the summit of the latter the necessary slope. He covers both extremities of the epaulement by means of short parapets *a*, *b*, (Plate 45, supp. 6, fig. 7.) which protect them from being battered in echarpe, and which being in an oblique direction, procure a flank defence from one epaulement to another.

It is behind these epaulements that, according to his plan, the cavalry, besides being covered by them before it begins to act, must repair to rally, if after charging it should be repulsed and partly broken. It will there be enabled to rally with the greater facility, as the unexpected and heavy fire that will proceed from them, by means of the infantry stationed in the ditch and on the banquette of the epaulement, will be sufficient to check the enemy. Besides, this infantry will have nothing to fear from the enemy's cavalry, since they are protected by the depth of the ditch and the elevation of the banquette of the epaulement.

Though

the part of the intrenchment it is intended to support; and for the same reason the officers commanding the different parts of the lines, should know to what brigade to apply, in case they require to be supported.

It is likewise advisable, that the officers of the different corps should acquire a perfect knowledge of the camp, in its whole extent, and particularly of the routes conducting to the posts assigned them. To ascertain whether the different corps know their respective stations, and can, at any time, repair to them speedily and without confusion, the general may sometimes give false alarms during the night; but they should not be too often repeated, as well not to fatigue the troops, as to prevent their becoming accustomed to them, and taking a real alarm for a false one.

Though this kind of works is abandoned, I have entered into this digression concerning them, because I acknowledge that I approve of them myself; not that I conceive they ought always to be made use of, nor even in every case where they were formerly employed, but because I am convinced there are positions where they may be of great service.

SECT.

SECT. VII.

Cannonade.

In treating of the attack of an intrenched camp, I have said that the assault is generally preceded by a heavy cannonade; if it be well directed and at a proper distance, it will doubtless facilitate to the assailant the means of approaching, and perhaps of making himself master of the intrenchments. It is therefore essential that you should derange its execution, and for this purpose the artillery of the intrenchments must make every possible effort to silence the enemy's batteries and render his cannon unserviceable.

SECT. VIII.

Defence against the approach.

If, however, the enemy's columns (which, during the cannonade, he has posted in such a manner as to be covered from the fire of the intrenchments) should advance, when they have arrived at a proper distance, and which must not exceed 300 toises, in order to admit of an accurate aim, you must direct against them the whole fire of the artillery, and pay

but

but little attention to the *tirailleurs*, who being dispersed cannot receive so much injury from the cannon. It is likewise of much less importance to put them in confusion than the columns, as it is the latter which are to make the most powerful attacks. The cannon must first be loaded with round shot, and notwithstanding the rapidity of the march of the columns, which, as I have said, keeps them exposed for a shorter time to the fire of the artillery, you must observe to fire slowly, that each shot may be sufficiently adjusted. By following this method, the artillery will produce much more effect than it could possibly do with a more brisk but ill-directed fire; as soon as the columns are near enough, you must then open upon them a heavy fire of grape-shot, which should be continued as briskly as possible, without however neglecting to take proper aim.

Lastly, a fire of musketry must be commenced, when the columns have approached sufficiently near for it to take effect, and the officers and non-commissioned officers must pay as much attention as possible that the men take aim, and do not expend their ammunition to no purpose.

SECT. IX.

Assault.

If this fire of artillery and musketry be insufficient to prevent the enemy from advancing, and he approaches the ditch, dispositions should then be made, and necessary measures taken to repel the assault.

Besides keeping up a brisk fire from every point from which the enemy may be annoyed by it, sorties must be made upon him, which will always produce a great effect when executed seasonably, in good order, and with vigour. You may in general rely considerably on the success of this mode of defence, which I consider as the most proper to intimidate and repel an assailant, who, already exhausted and thrown into greater or less confusion by the fire he has to sustain, and the different obstacles opposed to him, must necessarily lie under a great disadvantage. But sorties should be directed with great prudence, and you should never advance inconsiderately.

If, in spite of your resistance, the enemy cross the ditch, and mount the parapets, the troops stationed behind them with loaded arms and fixed bayonets ought, the moment he appears,

pears, to attack and tumble him into the ditch. A most vigorous attack must also be made on the heads of his columns when entering the breaches, and a brisk fire of grape-shot directed against them.

Lastly, should the enemy be penetrating your intrenchments, and your troops be obliged to abandon the parapets, they must be instantly supported by those of your reserves which have not yet been engaged, and by your cavalry; and if both these do their duty, it is next to a certainty that they will repulse an enemy, who, exhausted and thrown into confusion by so many successive attacks, has, as I before observed, to sustain an unequal contest with troops who are fresh and in good order. But you must keep your *sang froid*, not yield to the impressions of panic fear, and know how to profit by your advantages.

I shall repeat the same observation relative to reserves which I made concerning sorties, namely, that I place very great confidence in them, and without limiting that confidence to the defence of an intrenched post, I extend it to all military operations whatever.

If the enemy, being repulsed, is to be pursued, or if, being victorious, he forces your army to retreat, the general who commands it

must, in both cases, determine the movements which it is necessary to make, and which do not belong to my subject.

The rules here laid down will easily be applied to an attack by night; I shall only observe that your activity and foresight should then be redoubled to avoid a confusion, which is always dangerous, but particularly in attacks of this kind. You may give light to the front of the intrenchment by means of light-balls thrown from mortars, or as Vauban proposes, place previously in front, at the distance of 200 toises from each other, and about 15 toises from the ditch, piles of wood, which must all be set on fire at the same time when the enemy approaches, and the inflammation of which is facilitated by means of straw and small branches intermixed with them. A small roof of boards is made to cover them, and to prevent the straw from getting wet.

SECT. X.

Defence of unconnected intrenchments.

The defence of connected and unconnected intrenchments are in many respects similar to each other. In fact, the disposition of the troops behind the parapet, the manner of preventing the enemy from approaching the works,

and

and lastly, that of repelling the assault, are absolutely the same, since the army placed behind the intrenchments accomplishes the same object, as the reserves of which we have spoken in the preceding section. I shall, however, observe that the nature of the movements of this army should differ according to its greater or less strength. Indeed, if it be greatly inferior in number to that of the enemy, and be covered by unconnected intrenchments, only because time and materials were wanting for the construction of others, being compelled by its feeble state to act solely on the defensive, excepting in particular circumstances, which it is impossible to foresee, its movements forward will, in general, have no other object than to defend the works which cover it, by endeavouring to repulse the columns that attack them; and when this object is accomplished, it will resume the position it before occupied behind the intrenchments.

If, on the contrary, the force of this army be not much inferior to that of the enemy, its movements will not only be executed with greater security than in the former case, as it will have less to fear from the proximity of the

enemy, but it will not be obliged to confine them to the defence of the works: and if after one or more unsuccessful attacks the enemy appear to be in confusion, it may, by means of the intervals which permit it to march out with an extensive front, attack him in its turn, and follow up its advantages.

But whatever may be the situation of the army, you ought never to neglect the precaution of protecting the intervals by the fire of the works. This attention is principally necessary, when the intrenched army is very weak, because the enemy, relying upon his great superiority, will not fail to attempt to penetrate by the intervals, at the same time that he will attack the works in front; and should he succeed, he will then attack the latter by the gorges.

SECT. XI.

Defence of forts.

The defence of field-forts is likewise conducted on the same principles as that of intrenchments, both with respect to the disposition of the troops which line the parapets, and the manner of impeding the approach, and repelling

pelling the assault. It should only be observed, when you man the parapets, to keep at least one fifth of the garrison as a reserve, ready to give assistance wherever it may be necessary.

Particular care ought likewise to be taken of the ammunition, for as it is probable that the enemy will throw many shells from howitzers, it would run great risk of being set on fire, unless proper precautions be taken to secure it. In case there should not be a well-constructed block-house in the fort, holes, as mentioned by the author page 121, section xxv. must previously be made. I shall add, that these holes must be opposite the merlons, and as close as possible to the parapet, without, however, obstructing the movements of the troops.

In treating of the attack, I have observed that the angles being commonly the weakest parts, it is advisable that the assailant should generally direct his march towards them, following the direction of the capital. It is therefore expedient, unless the fort has particular points to batter, such as a defile, or excepting the ground in front of the angles be such as to prevent the enemy from approaching

ing

ing towards them, to place there a piece of artillery, at least in those which are thought to be the most exposed.

SECT. XII.

Defence of têtes-de-pont.

If a tête-de-pont, as I have already said in treating of the attack, cover a communication of little importance, the enemy will endeavour to make himself master of it, either by means of a cannonade, by which he will hope to oblige the garrison to evacuate it without waiting till the works shall be scaled; or he will attempt to take it by a coup de main by the latter method. In the first case, it ought certainly to be recommended to the troops stationed in the tête-de-pont, to maintain themselves in it as long as possible, both by answering the enemy's fire, and endeavouring to dismount his artillery, by means of that which they may have in the work, and to impede, by the methods before mentioned, the approach of the enemy, in case he should advance. Should he notwithstanding scale the works, the garrison must endeavour to repulse him, conformably to the rules already given for defending itself against this mode of attack.

If,

If, on the contrary, the tête-de-pont cover an important communication, as it will probably have been constructed so as to make a vigorous resistance, and will even, perhaps, be supported by a body of troops, in addition to the garrison, the enemy will not be able to make himself master of it without proceeding to a regular attack, and the means of defence in such cases have already been sufficiently explained.

If a tête-de-pont be intended to facilitate the passage of an army, or any body of troops whatever across a river, in order to advance towards the enemy, its defence, particularly if it be attacked in an imperfect state, will be principally supported by the fire of the opposite shore, and by the troops which have already passed over: every effort must be made to keep the enemy at a distance, and prevent him from opposing the passage of the rest of the troops.

Lastly, if a tête-de-pont be intended to cover the retreat of an army forced to recross a river, it must be covered by that army, at least as long as the latter is capable of keeping the enemy in check, either by the positions it has taken, or by the number of troops which have

not

not yet crossed. I shall only observe, that as soon as the enemy is at a suitable distance from the tête-de-pont, a heavy cannonade must be commenced, and kept up against him, till the army has defiled; and if the cannonade be insufficient to prevent the enemy from advancing, and he approach within musket-shot, besides the fire of the artillery, a brisk fire of musketry must be opened upon him, and continued till the garrison shall have completely retired. Should he attempt to mount the parapets, he must be resisted in the manner already described.

With regard to the evacuation of the works which compose the tête-de-pont, and which ought to be successive, as I have observed in treating of the attack, it ought to be executed in the best possible order, and under a brisk fire of the works which are not yet evacuated.

SECT. XIII.

Defence of a church-yard, church, castle, country-house, and small town.

The rules to be followed in the defence of a church-yard, church, castle, country-house, or small town, have already been sufficiently explained both in the text of the author, and in the

the annexed notes. It has, besides, been observed, that posts of this kind are never capable of making a long resistance when attacked with cannon. It is therefore unnecessary to enlarge on that subject, and I shall only add, that if the garrison of these posts be provided with artillery, as well as the assailant, it should make every possible effort to render that of the latter unserviceable, otherwise he will soon oblige it to surrender; or it would be much better to erect outside of the post, and in the most favourable situation, a work, the construction of which would not require more time than would be wanted to put the former in a state of defence by the means proposed by the author, and where the garrison would be sheltered from the fire, which it has particularly to dread in posts of this kind.

SECT. XIV.

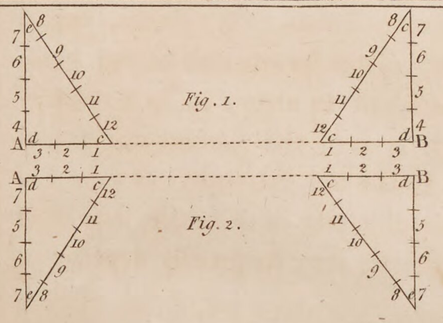
Defence of intrenched villages.

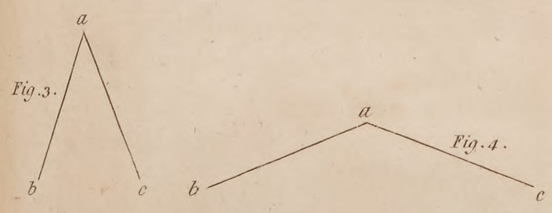
I shall here make the same observation as in the preceding section; that is, that the measures to be adopted in the defence of intrenched villages having been sufficiently explained in the text of the author, the notes annexed to it,

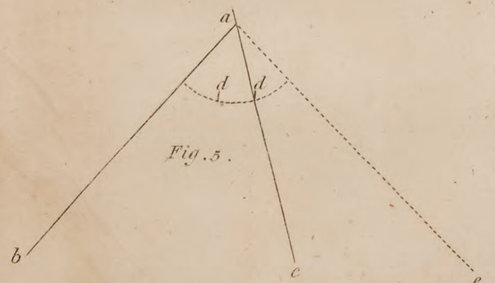
it, and the chapter on the defence of intrenchments in general, I shall only observe, that if an intrenched village be situated in the front, or on the flanks of an army, or in a chain of cantonments, it is of the utmost importance to defend it to the last extremity, as upon this circumstance the fate of a battle, and even that of the army, may frequently depend.

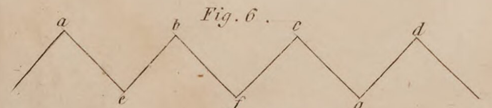
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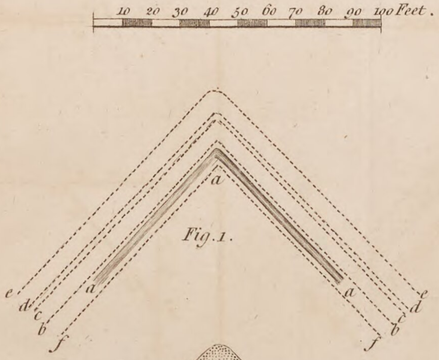
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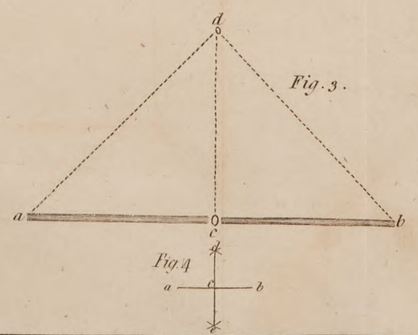


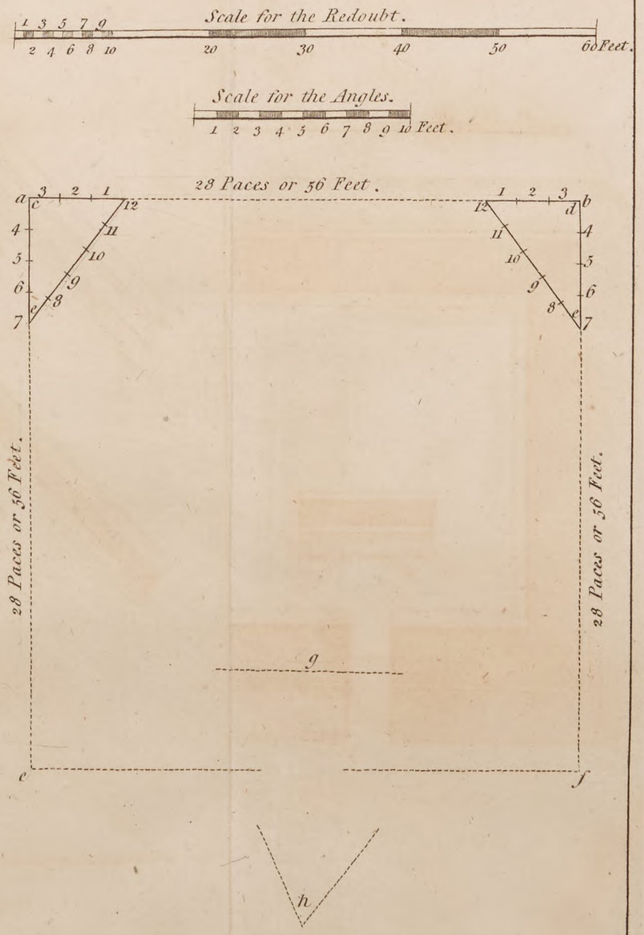


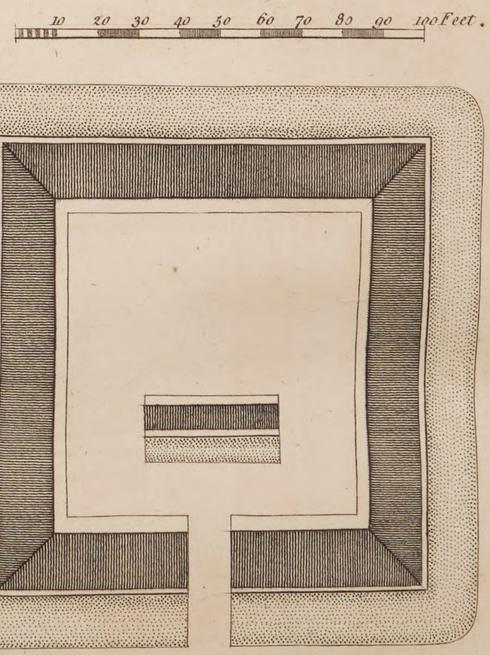






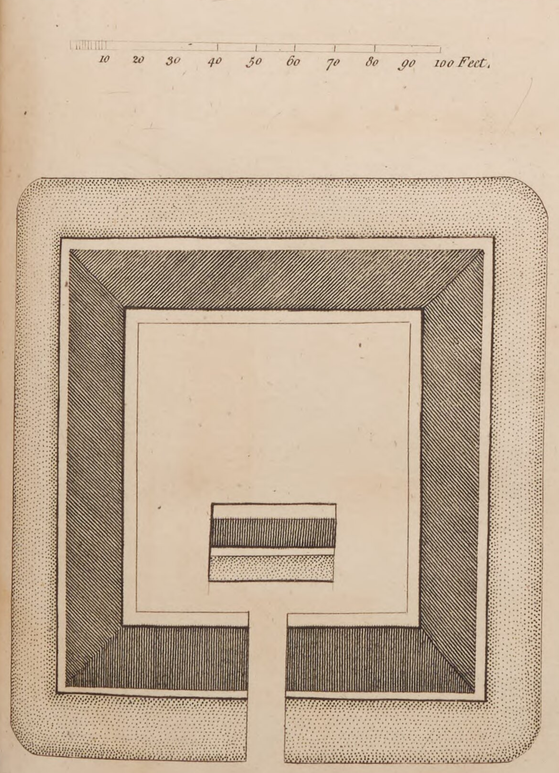




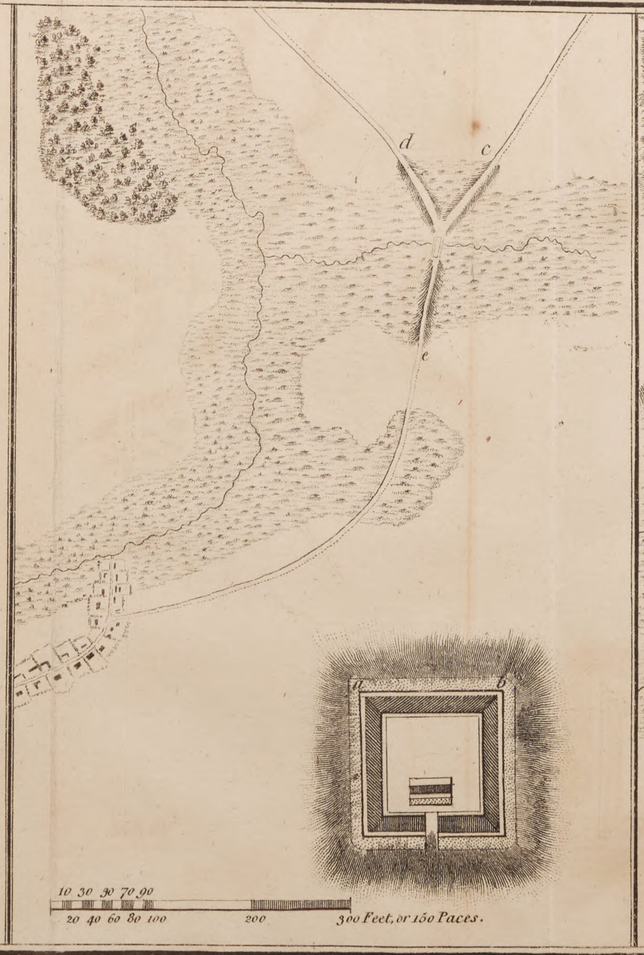


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Pl. 5



Pl. 6

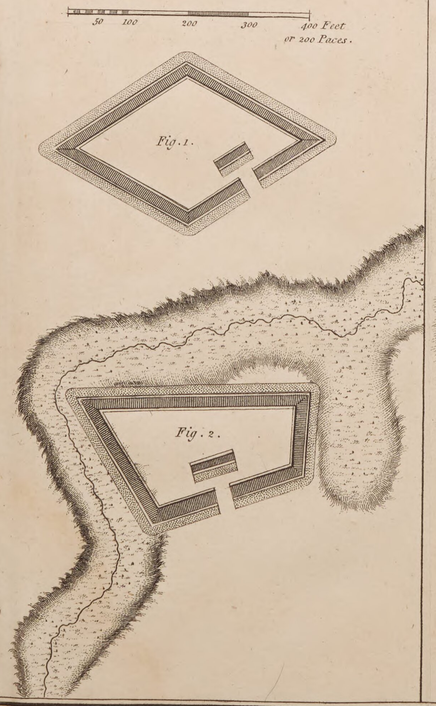


Pl. 7

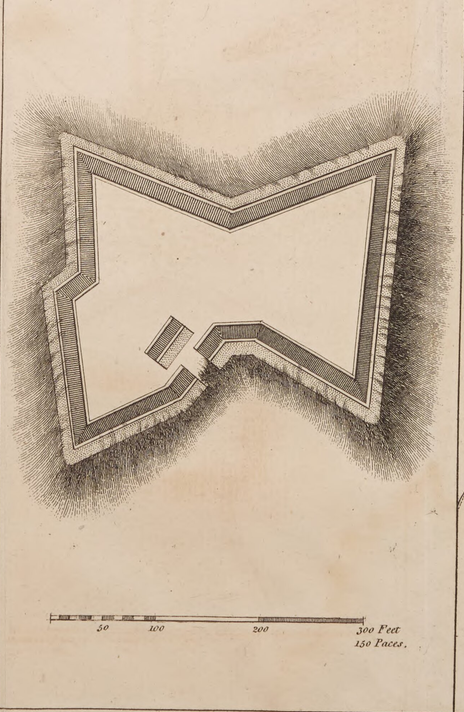


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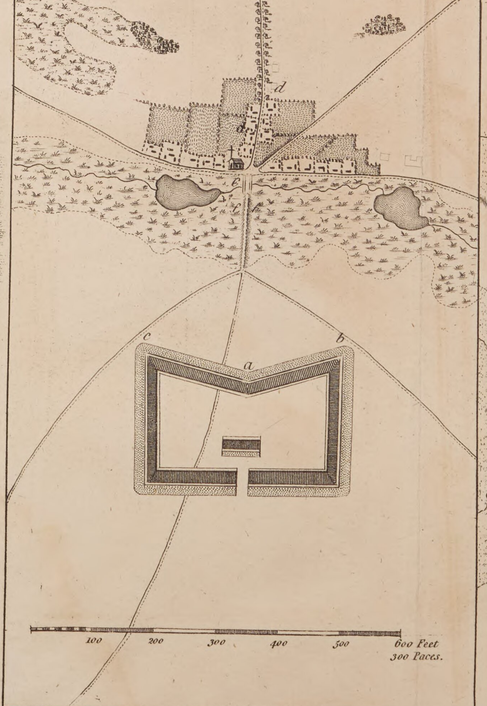
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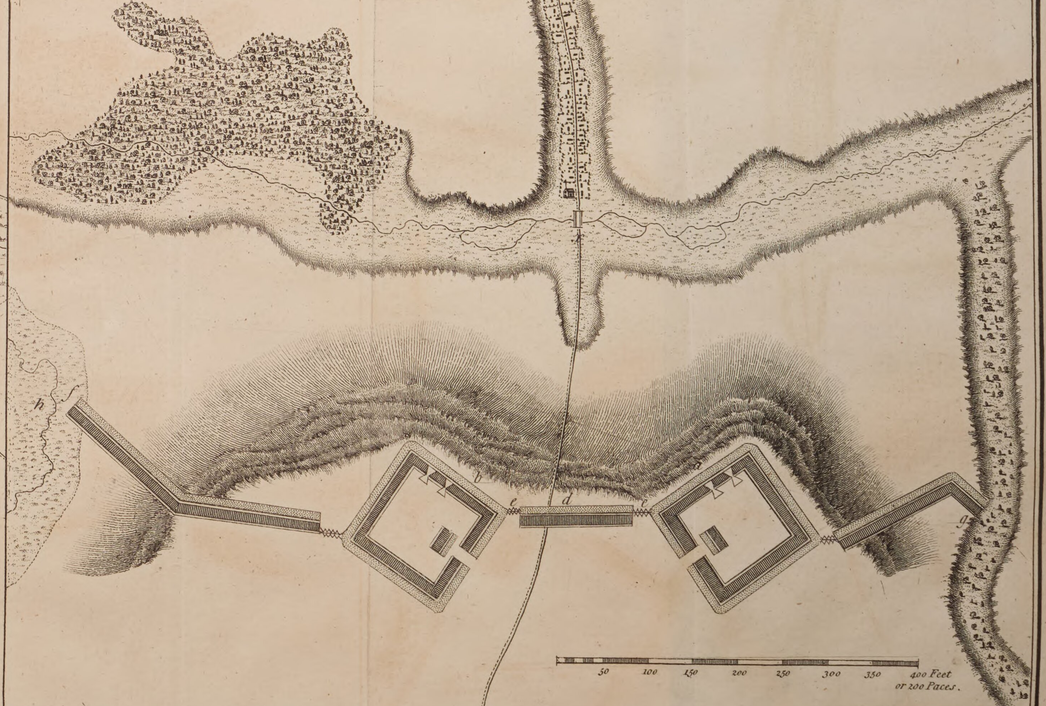
Pl. 9



Pl. 10

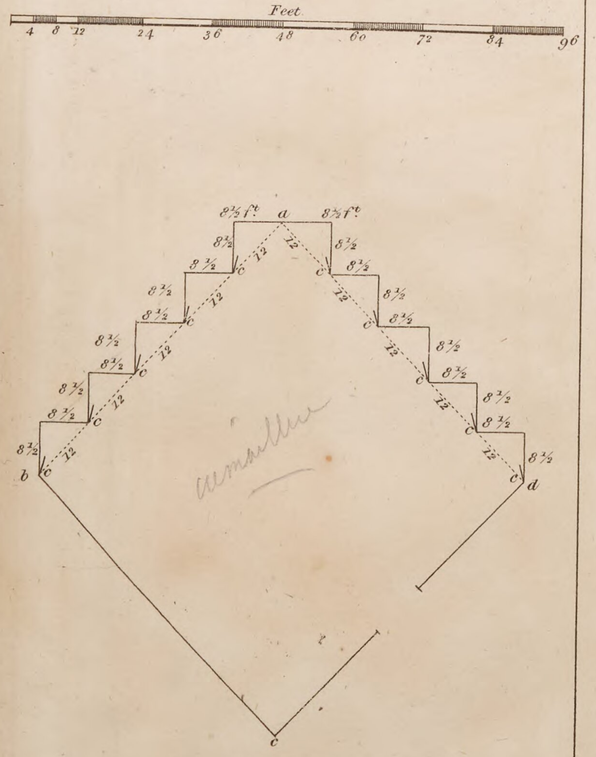


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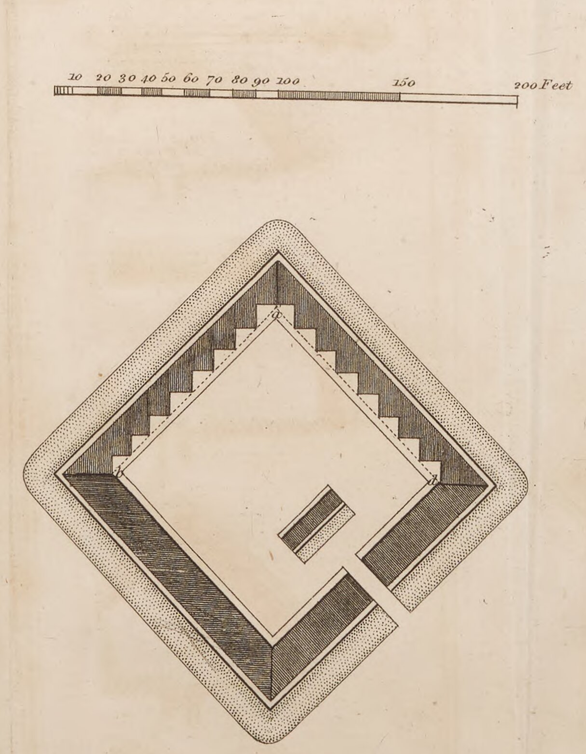


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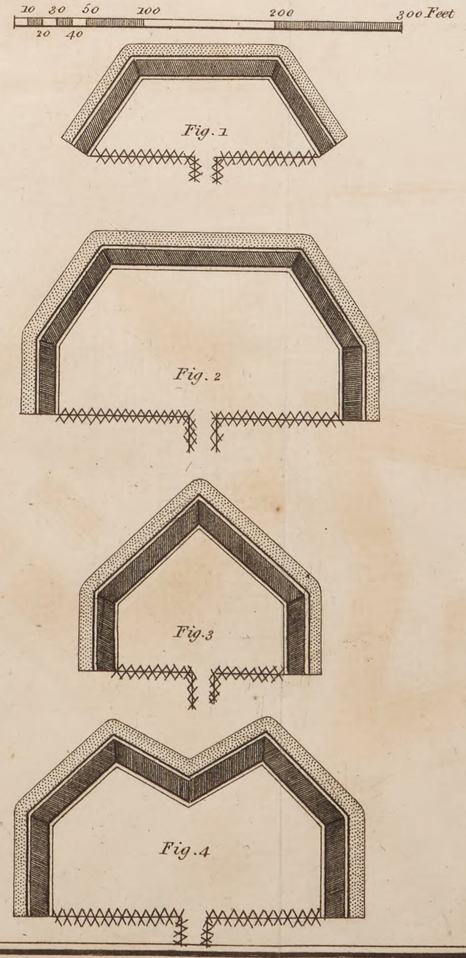
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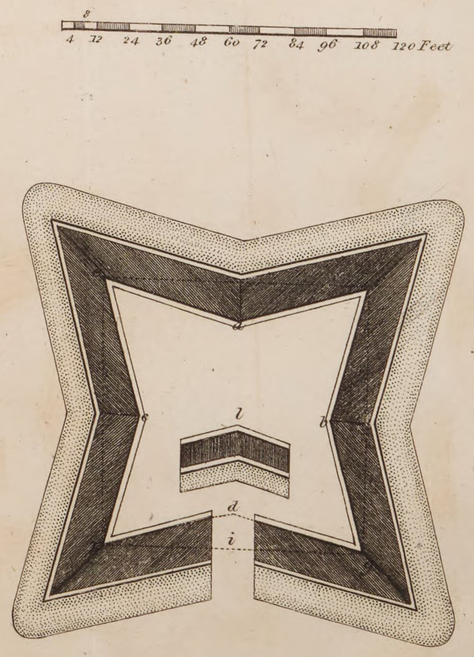
P 13



P 14



P 15



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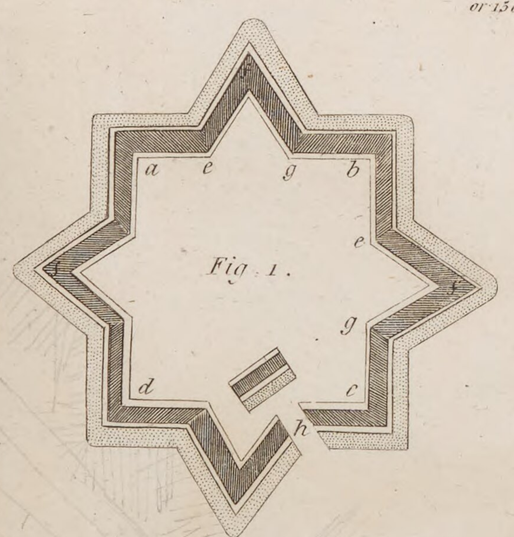


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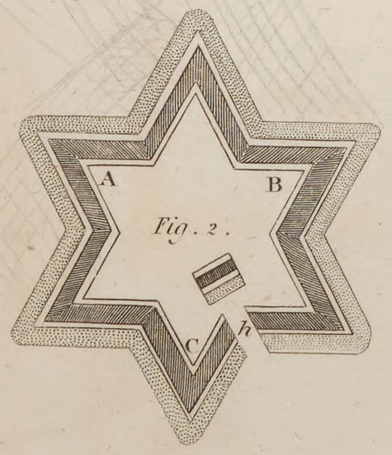
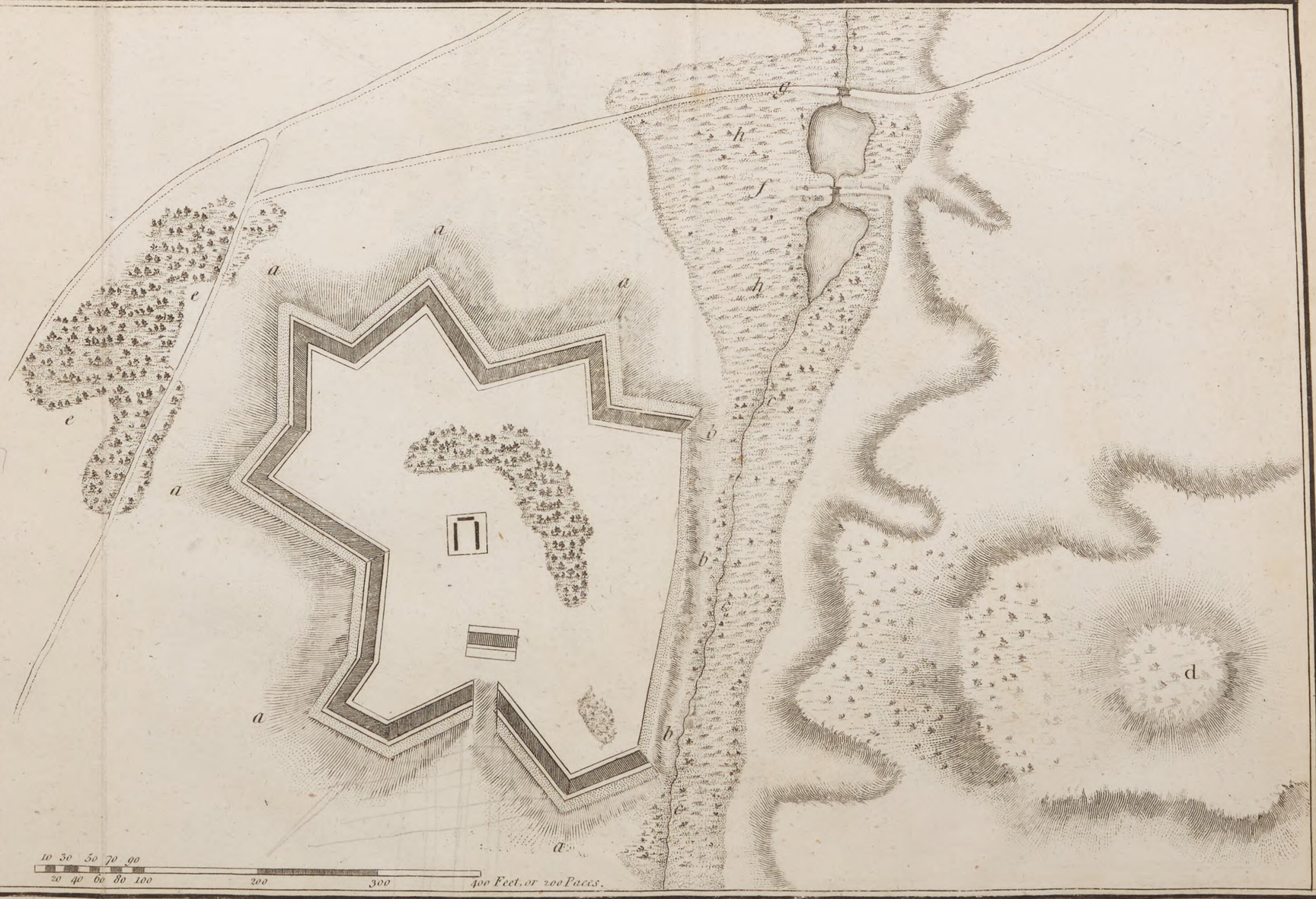


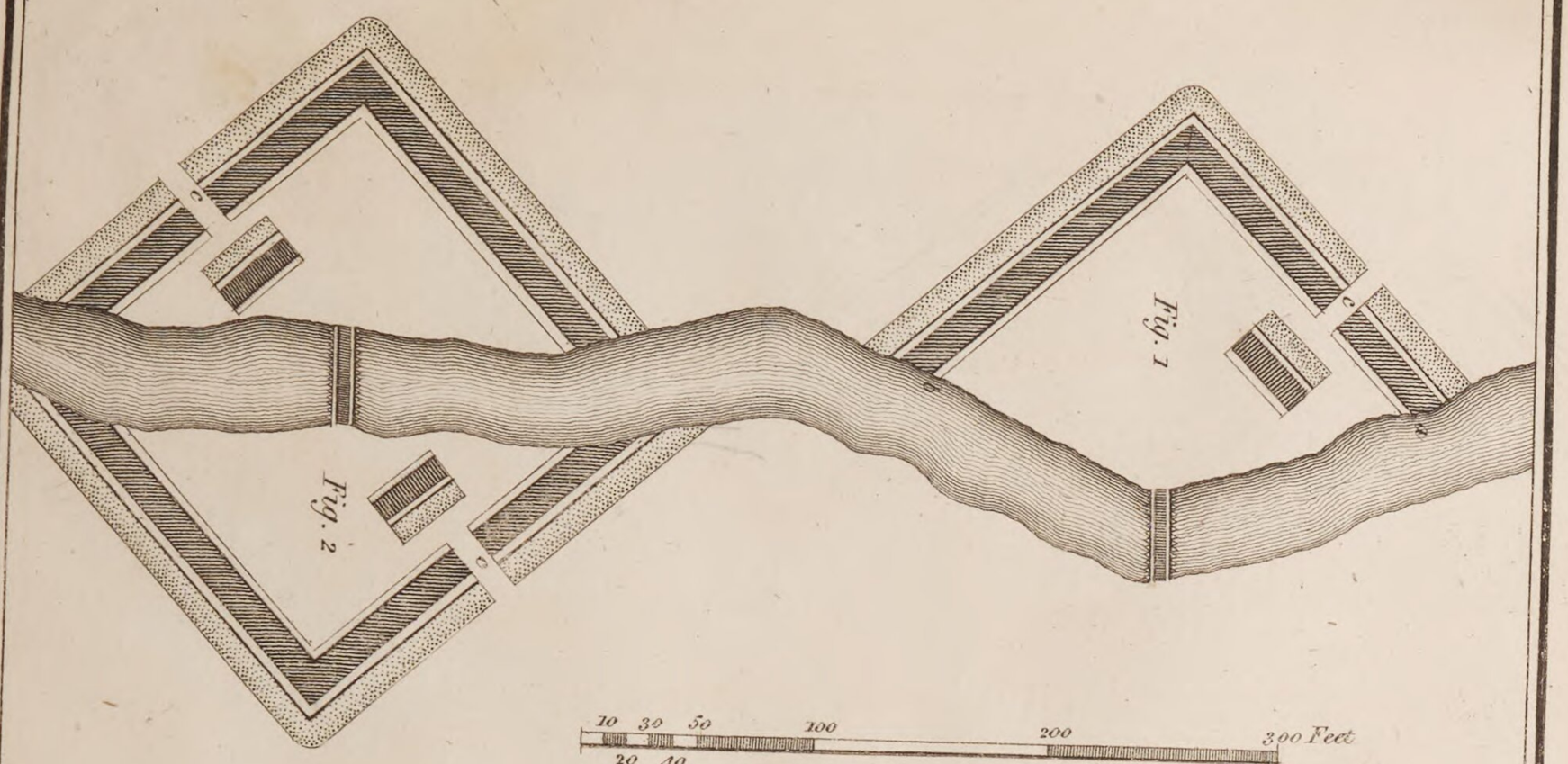
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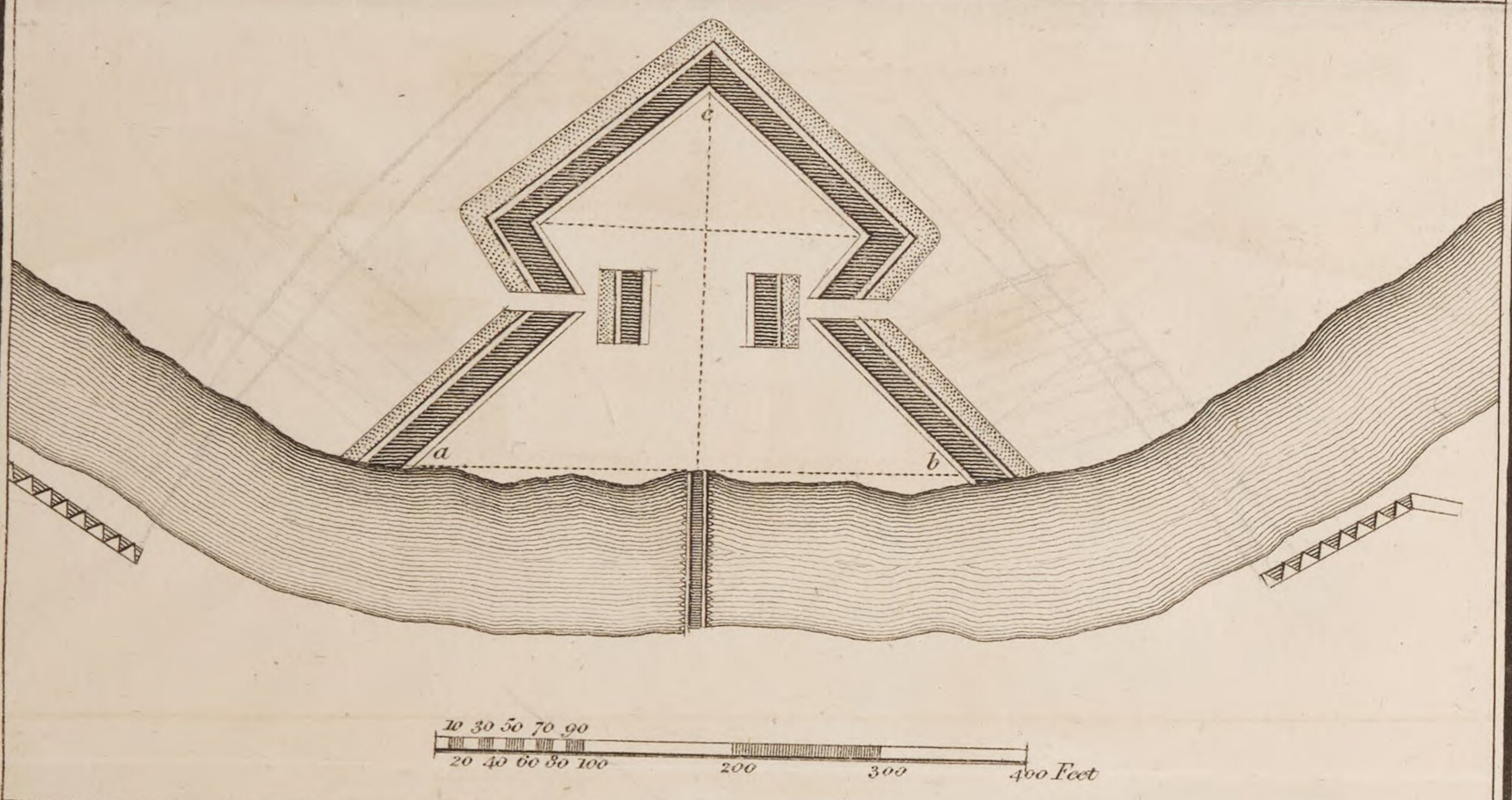
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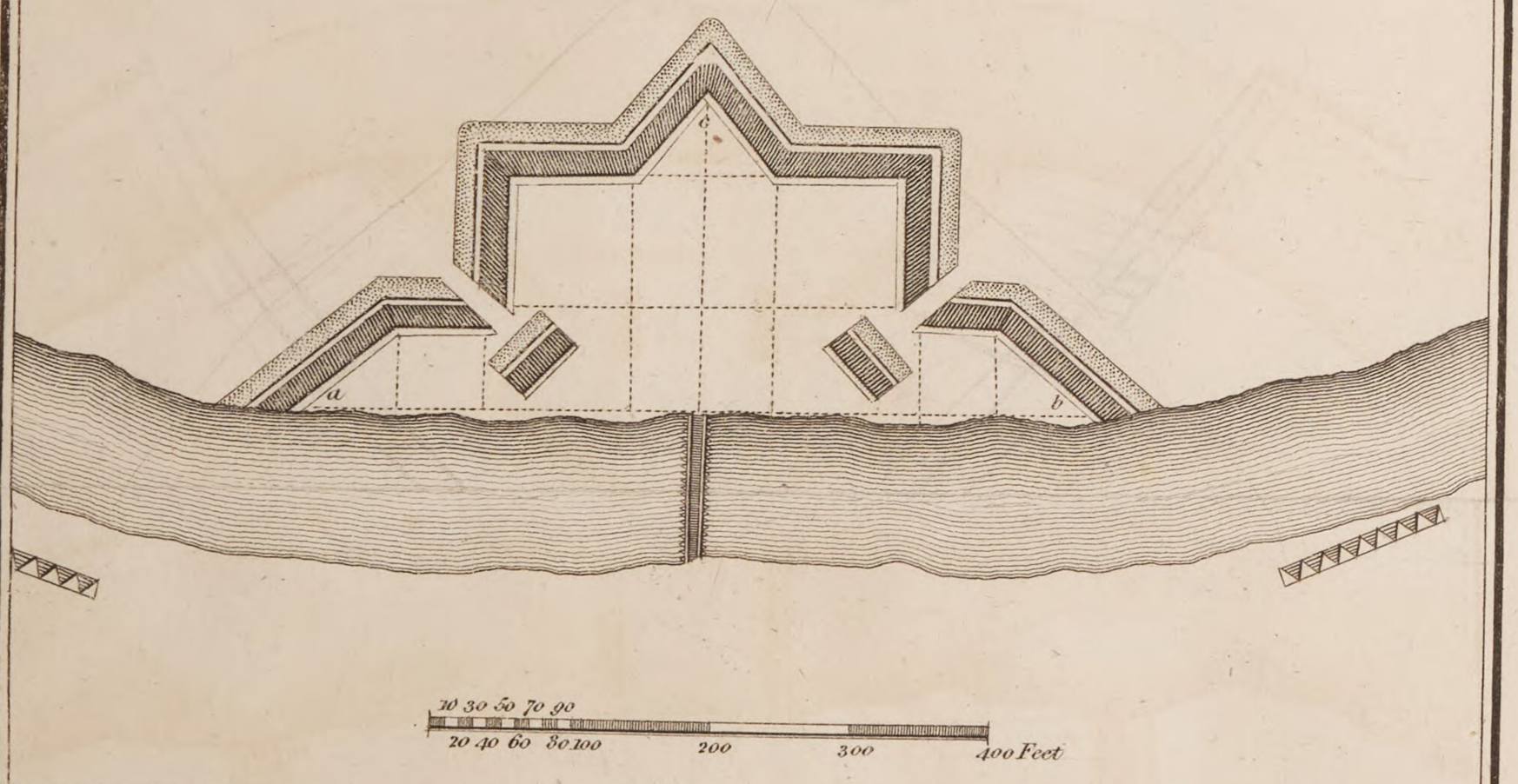
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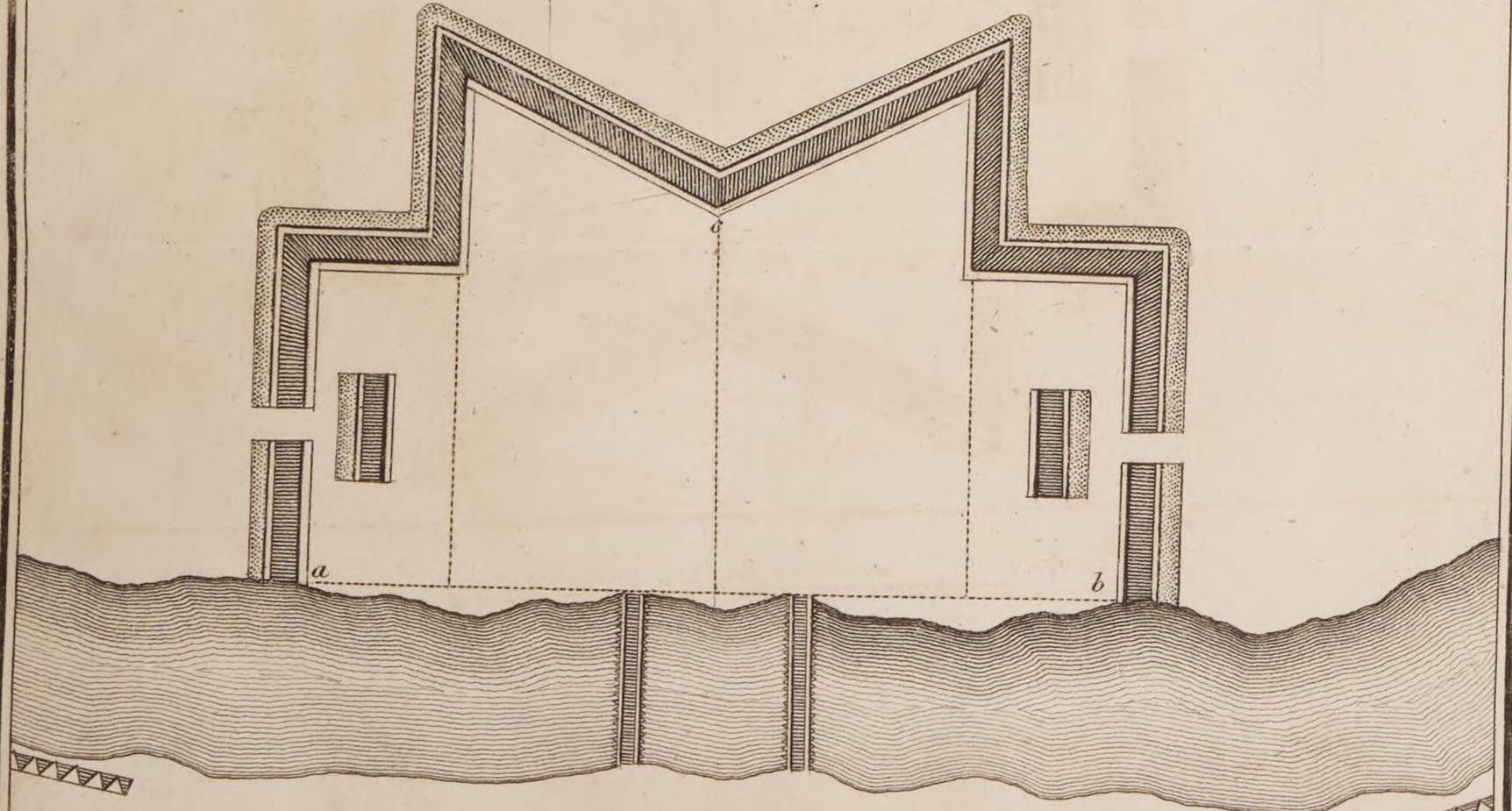
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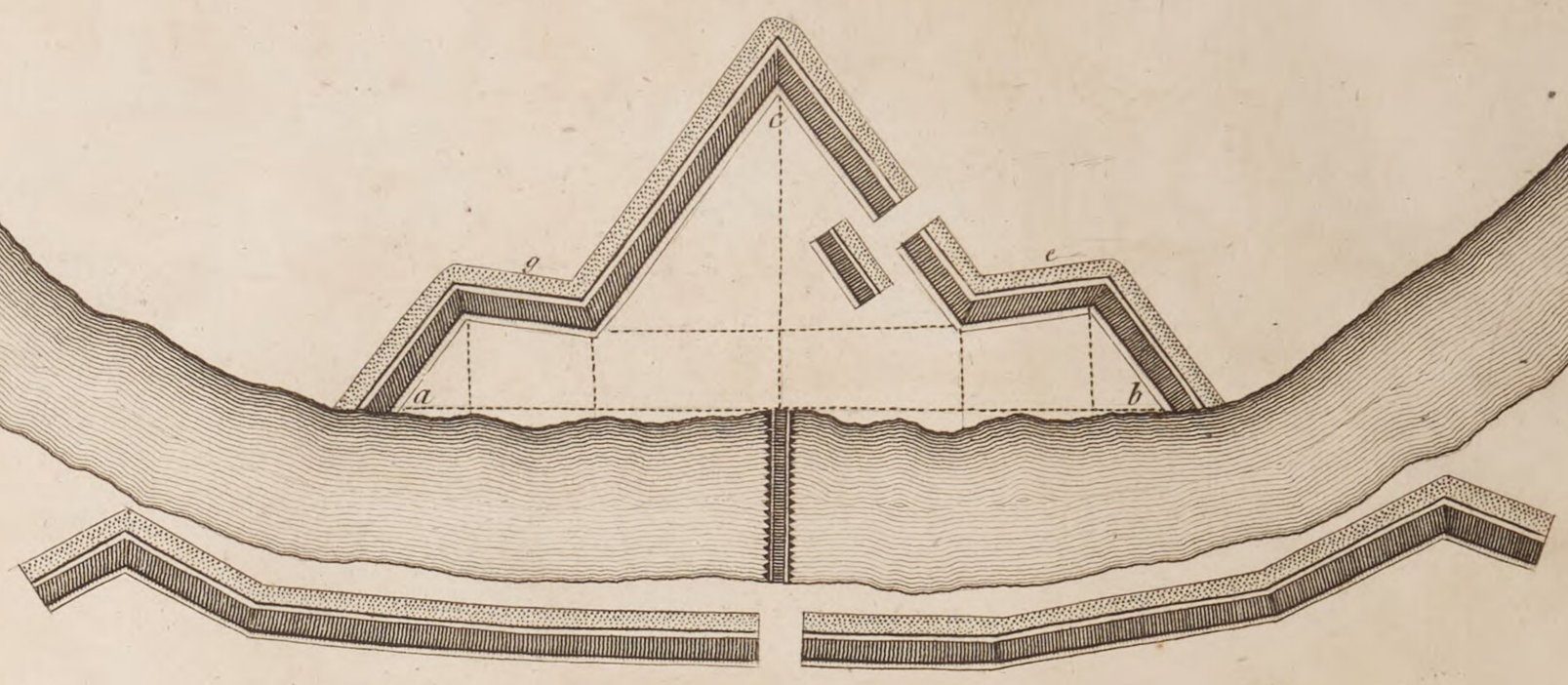
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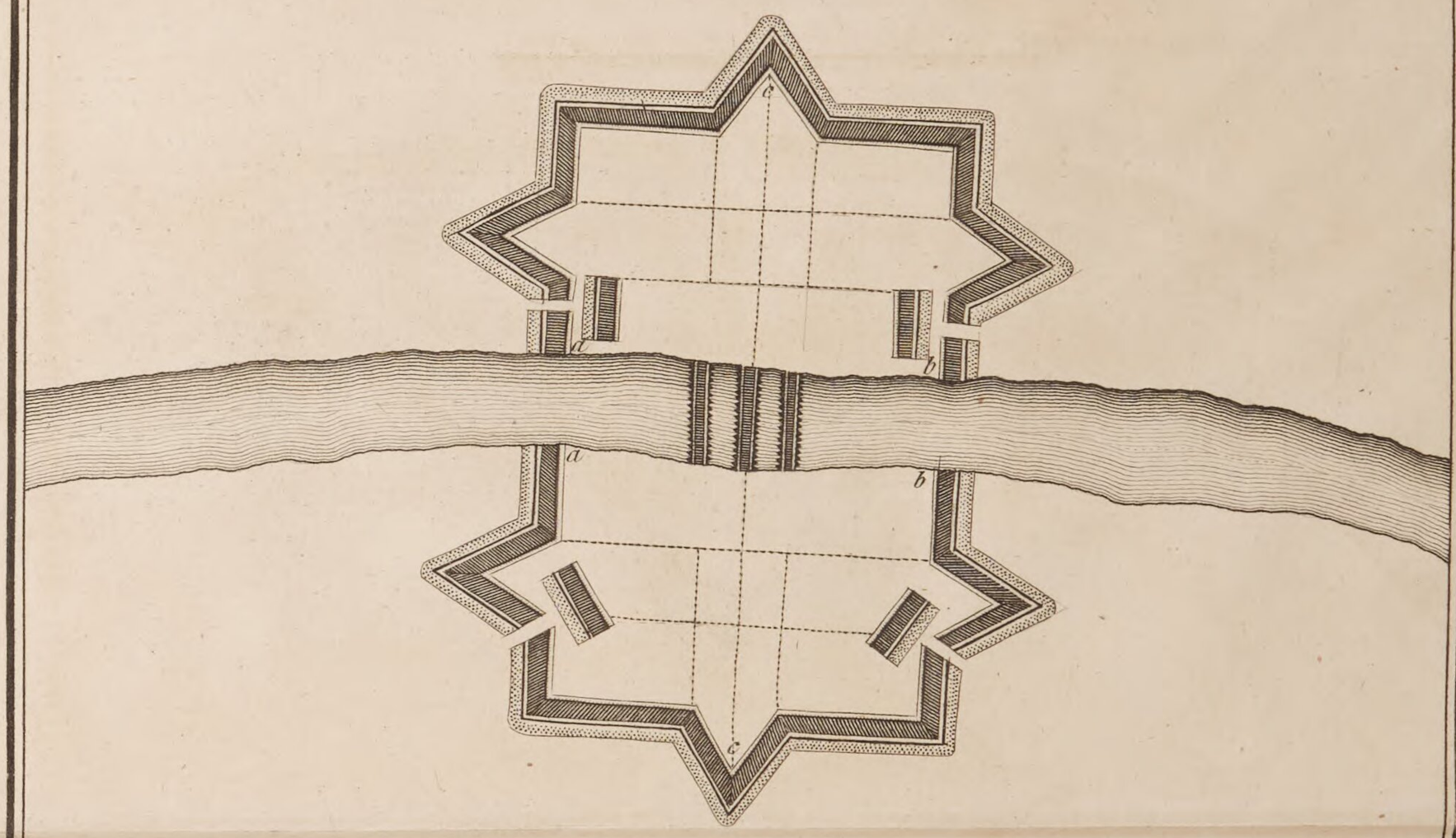
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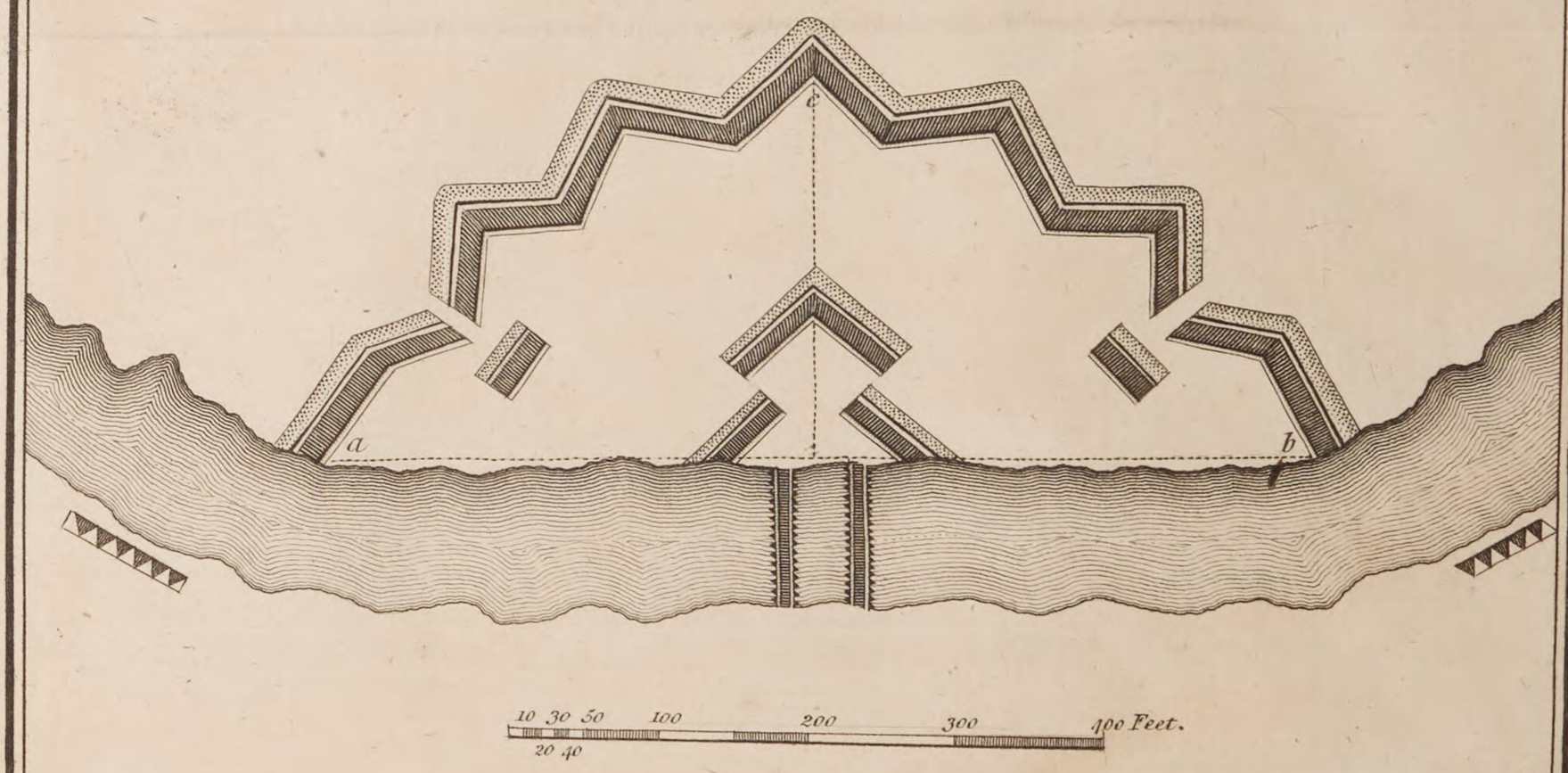
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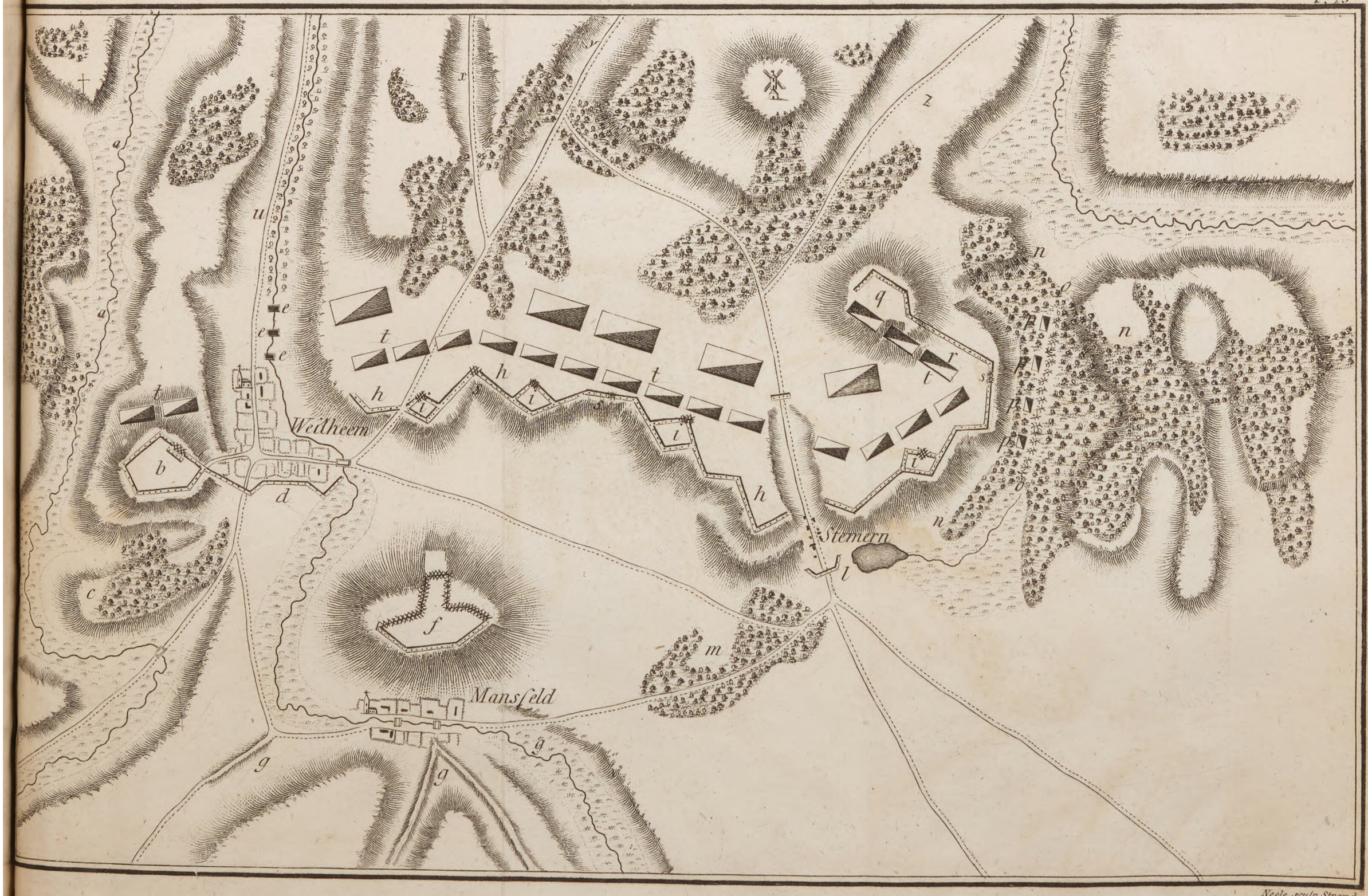


Pl. 23



Pl. 22





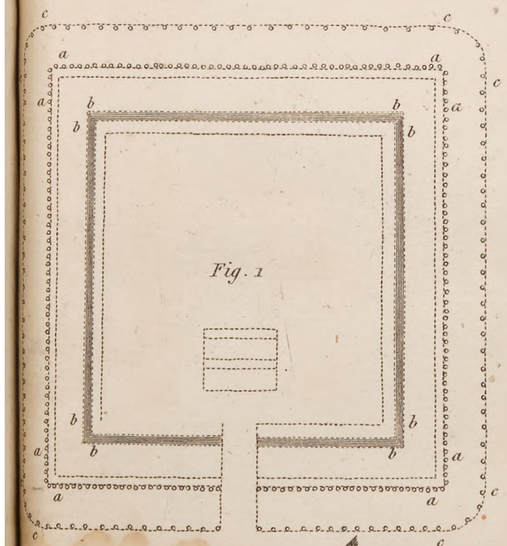
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P. 26

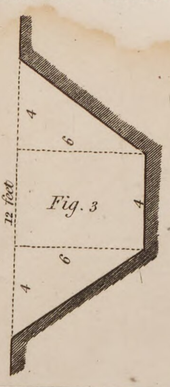
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P. 28

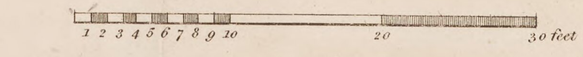
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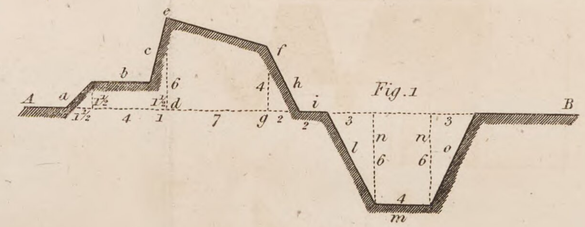


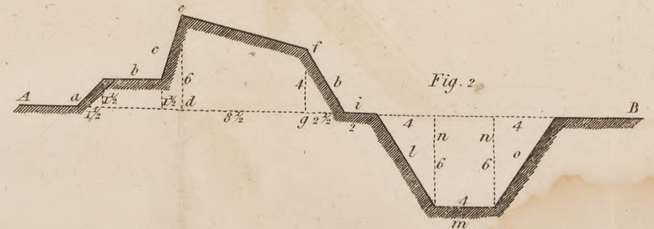












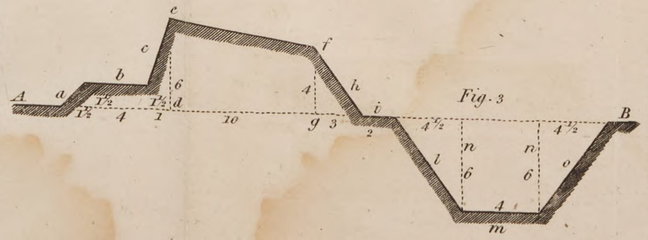
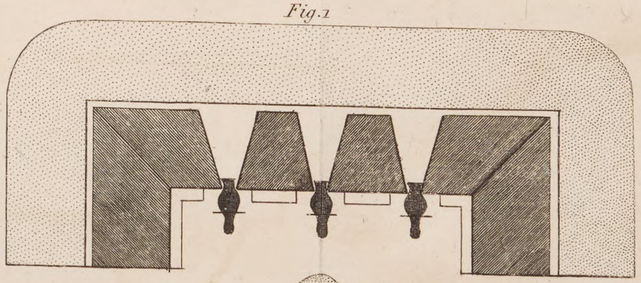


Fig. 1



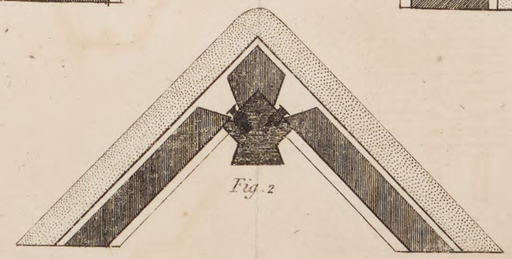
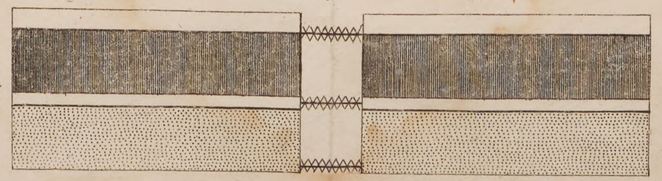
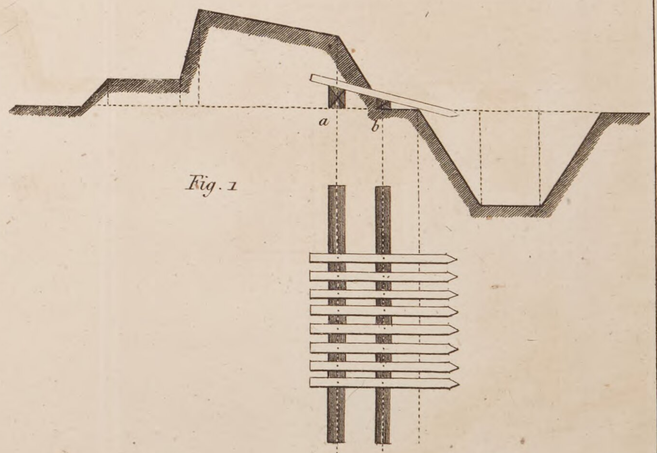
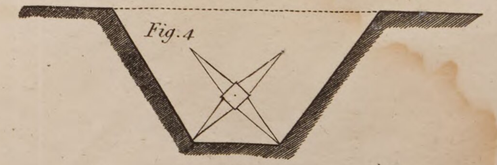


Fig. 3









Pl. 30

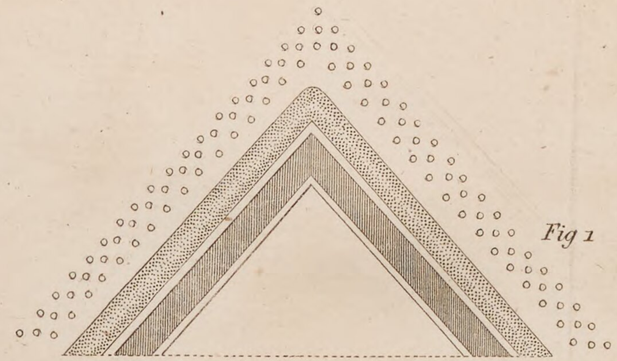


Fig 1

Fig 2

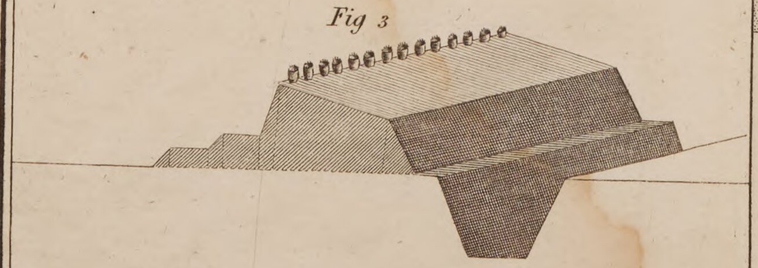


Fig 3

Pl. 31

Fig 1

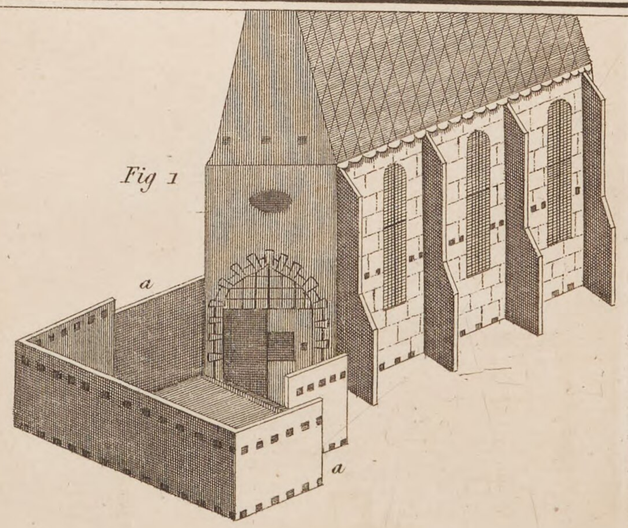
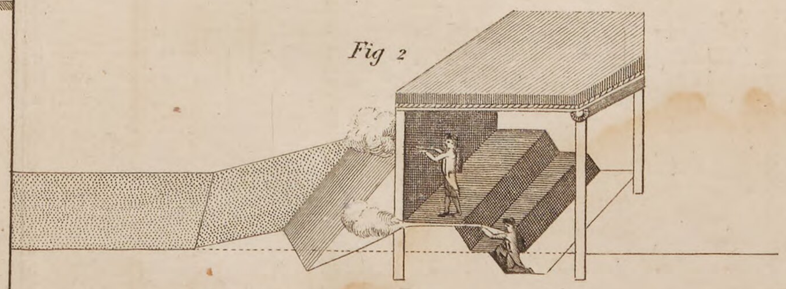
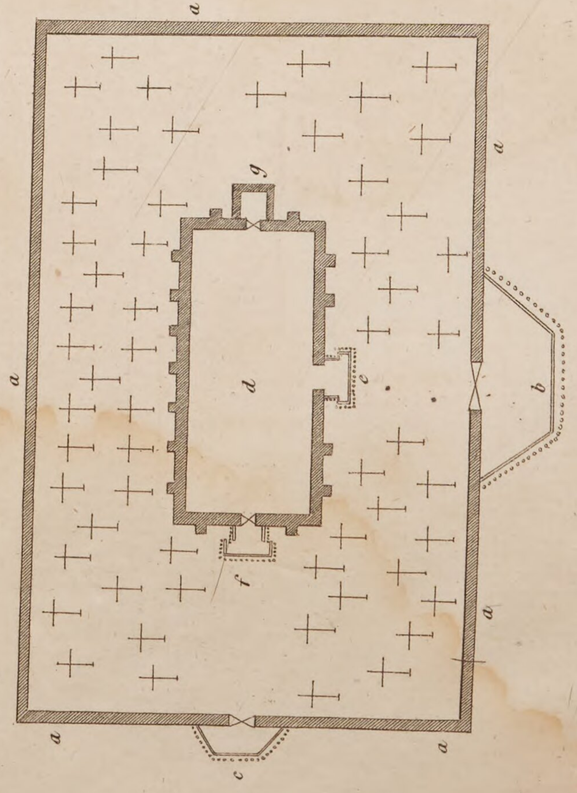


Fig 2



Pl. 32

a Wall of the Church-yard
b c Porticos at the entrance
d The Church
e f Porticos before the doors
g The Vestry



D

D

l

l

l

f

f

c

h

Stables

Barns

m

d

g

h

c

g

h

c

x

B

A

Dungeon

z

the Court Yard

a

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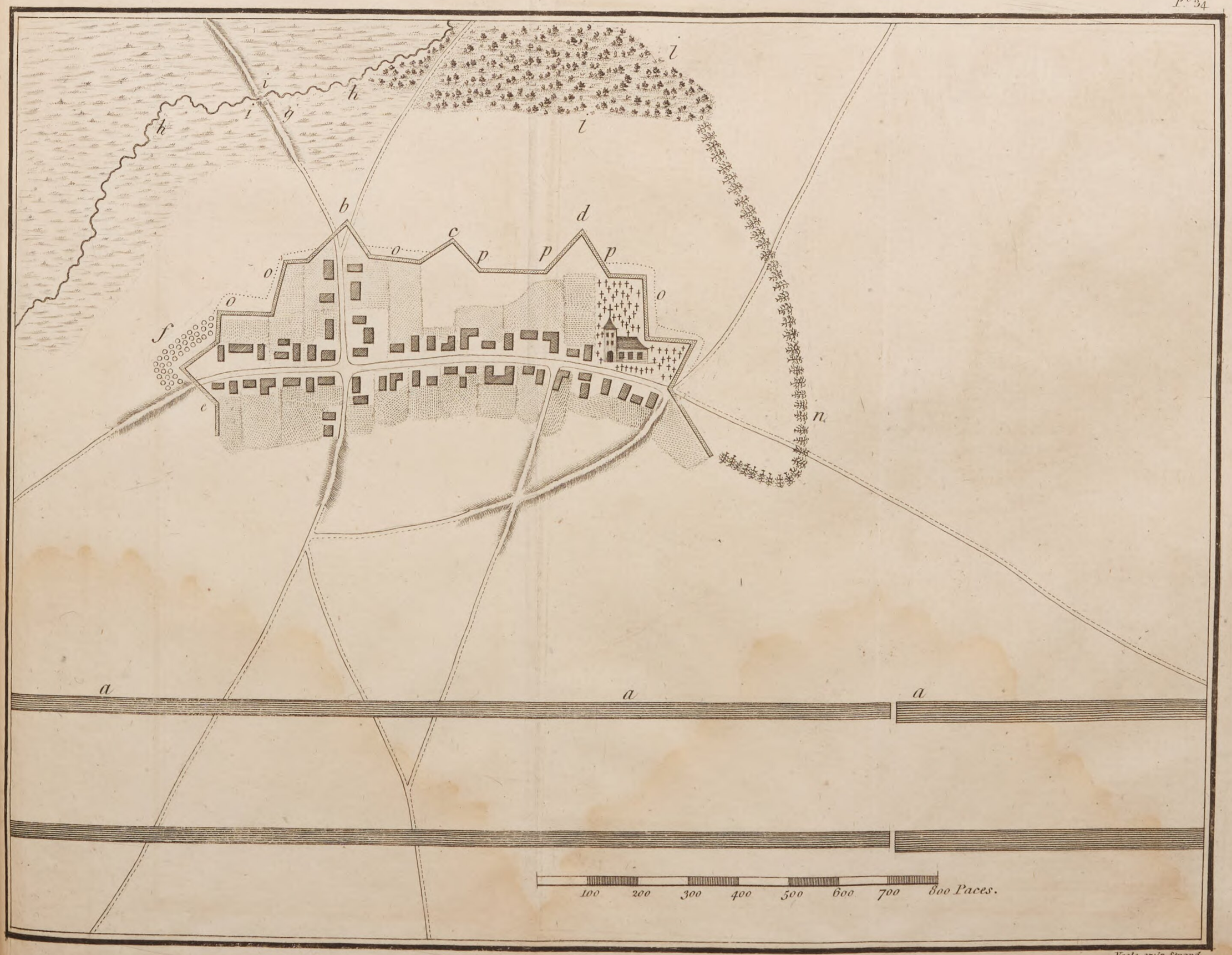
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P.ⁱ 35

P.ⁱ 36

P.ⁱ 37

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Camp

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Fig. 1.

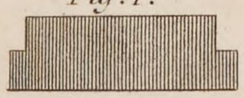


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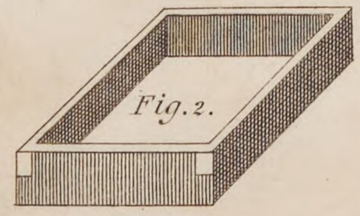


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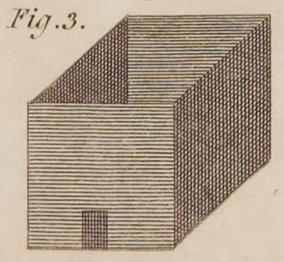


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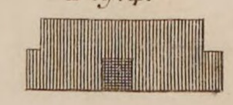
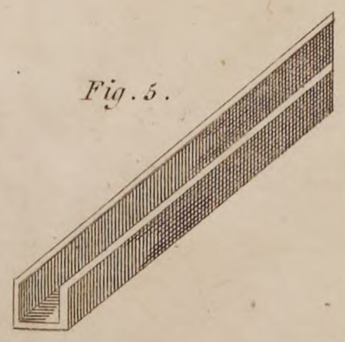


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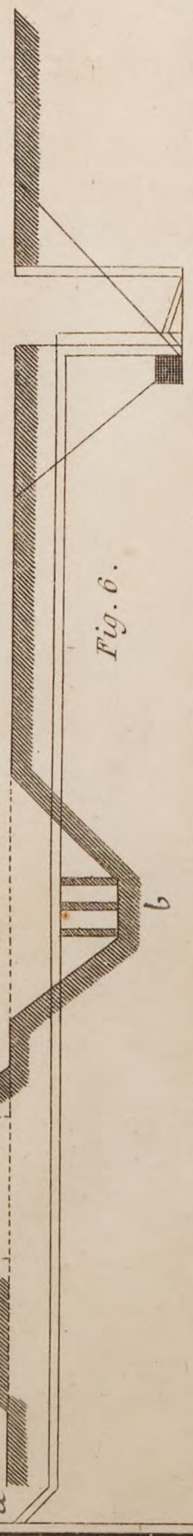


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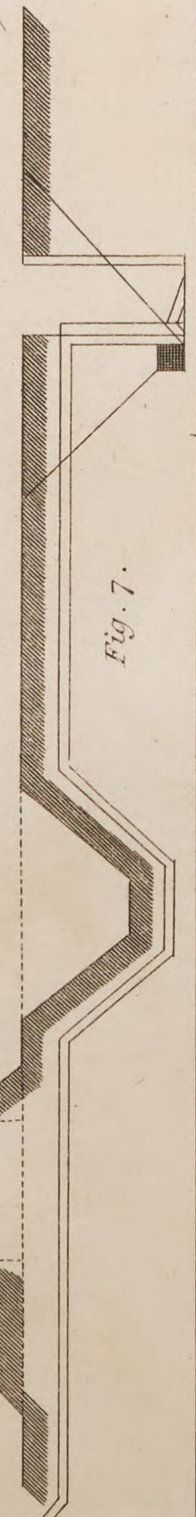


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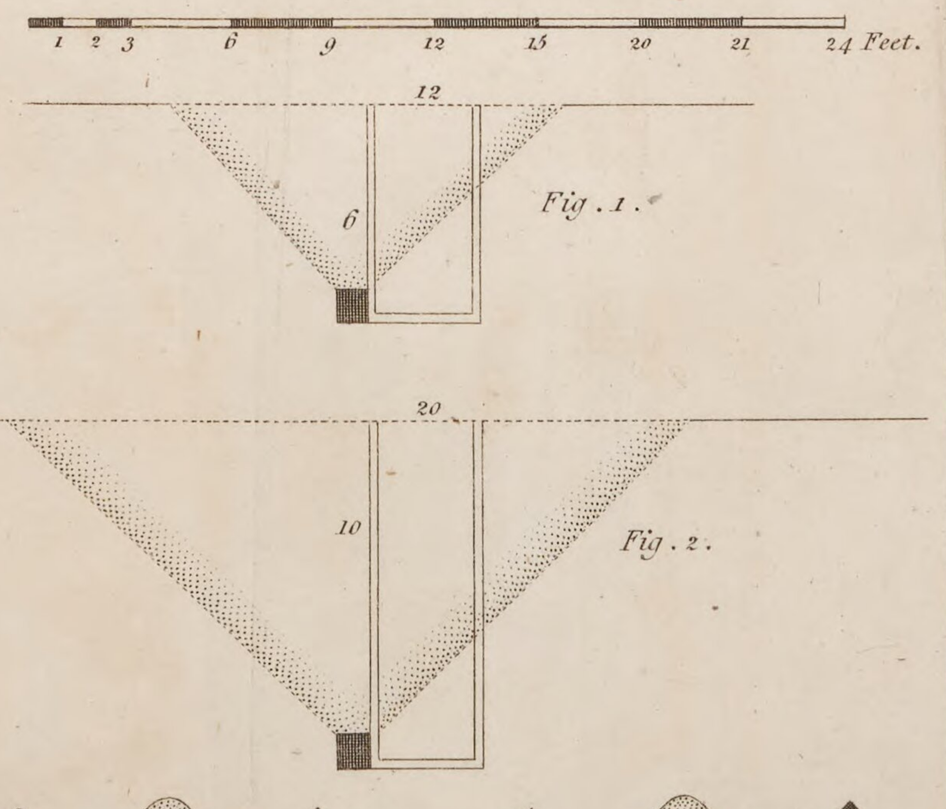


Fig. 1.

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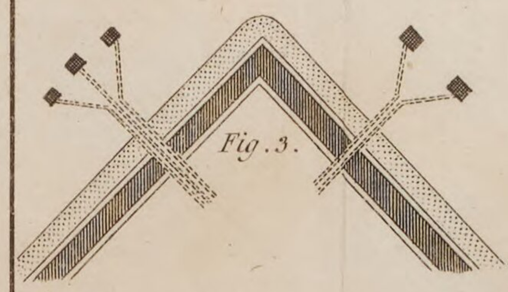


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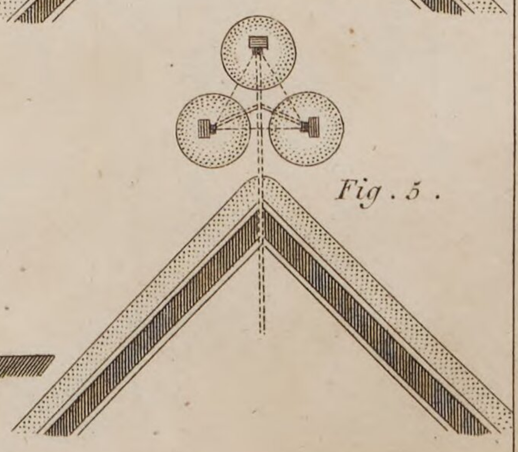


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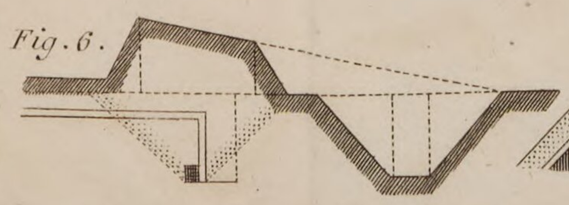


Fig. 6.

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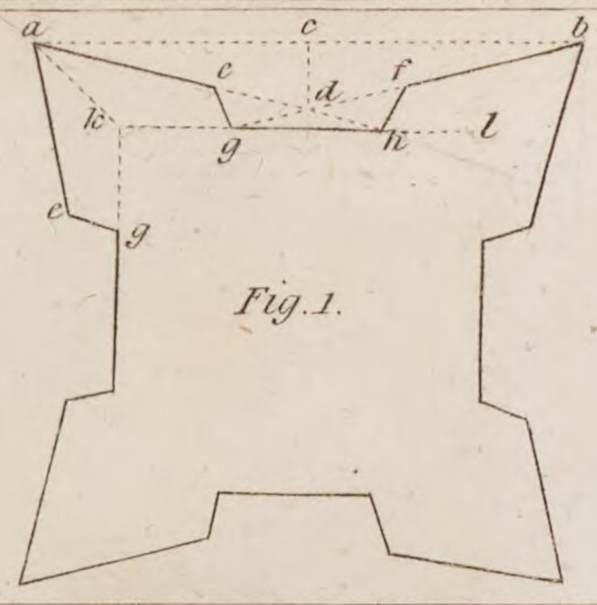


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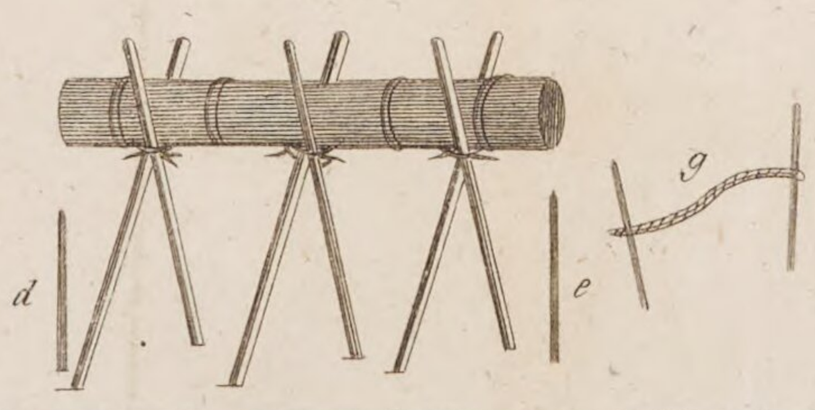


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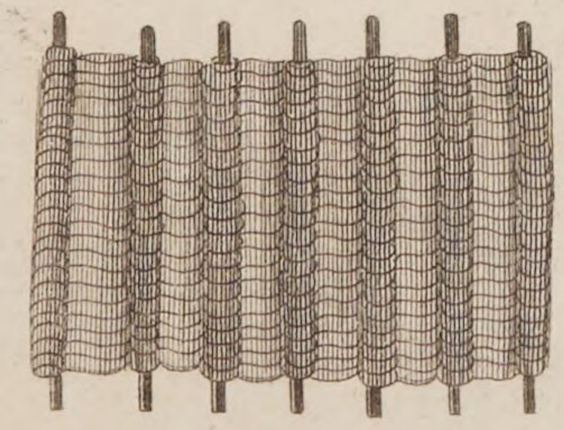


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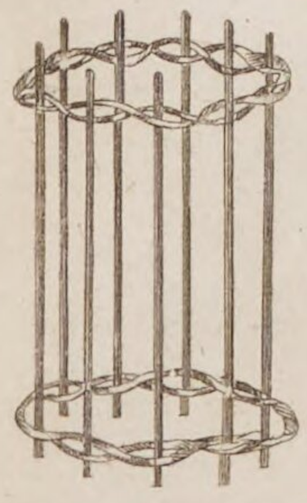


Fig. 5.



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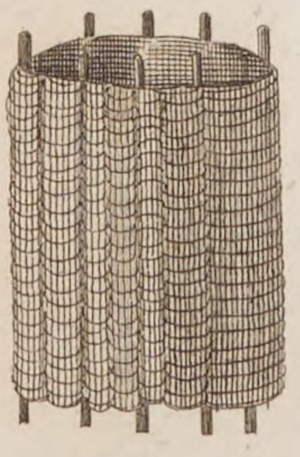


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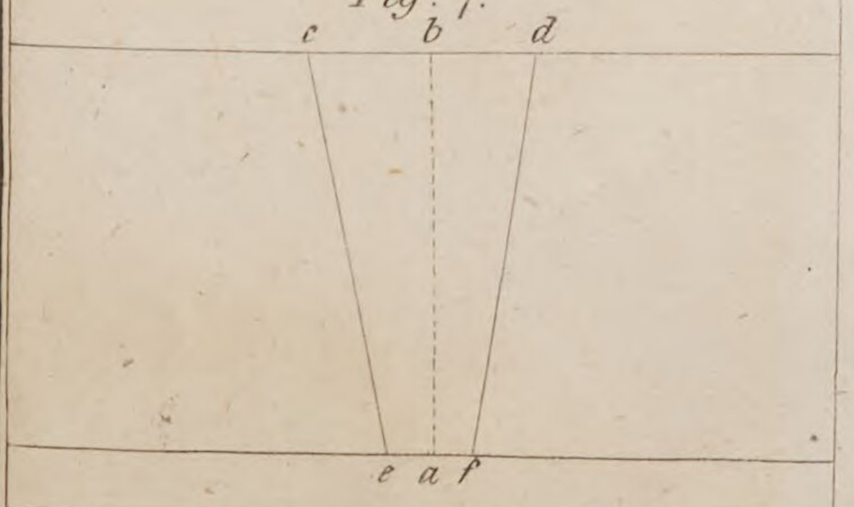


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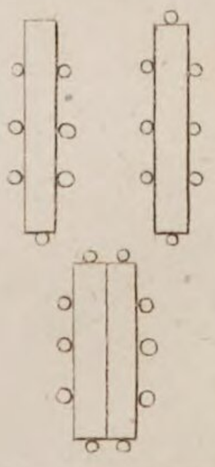


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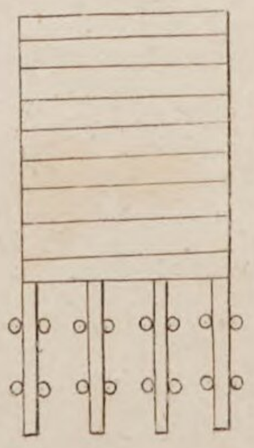


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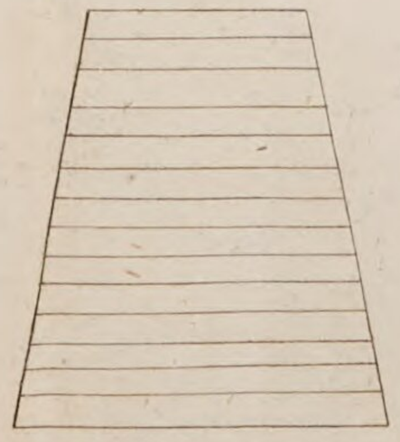


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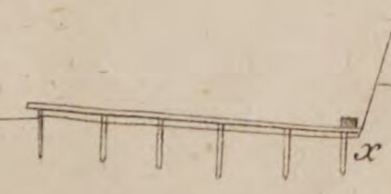


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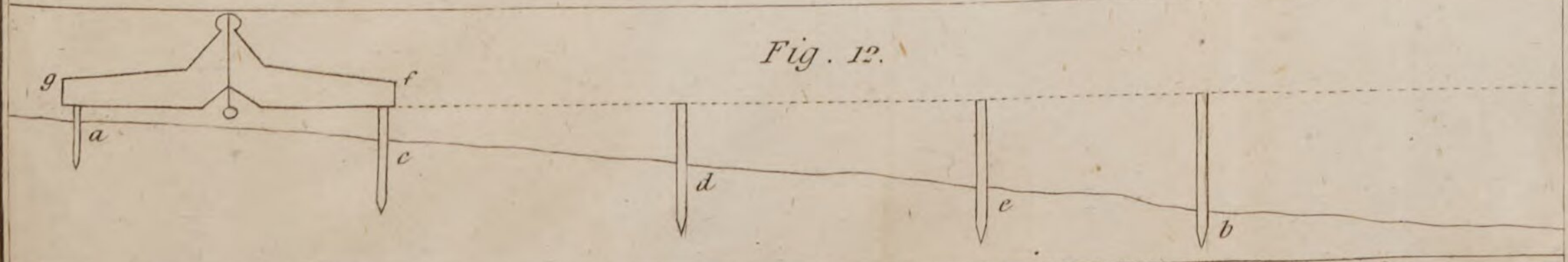


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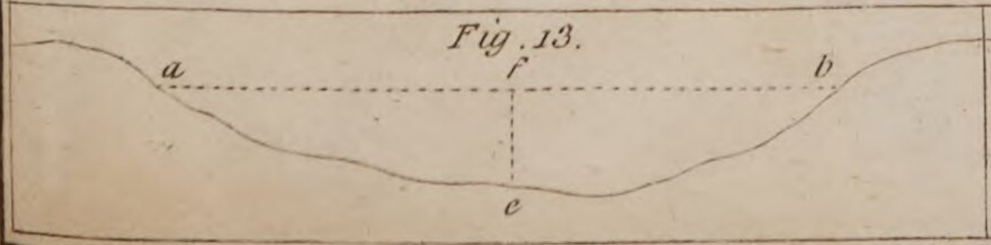


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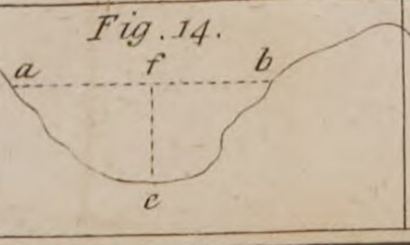
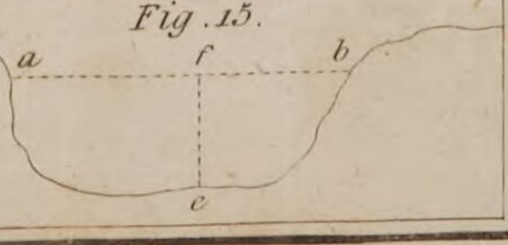


Fig. 15.



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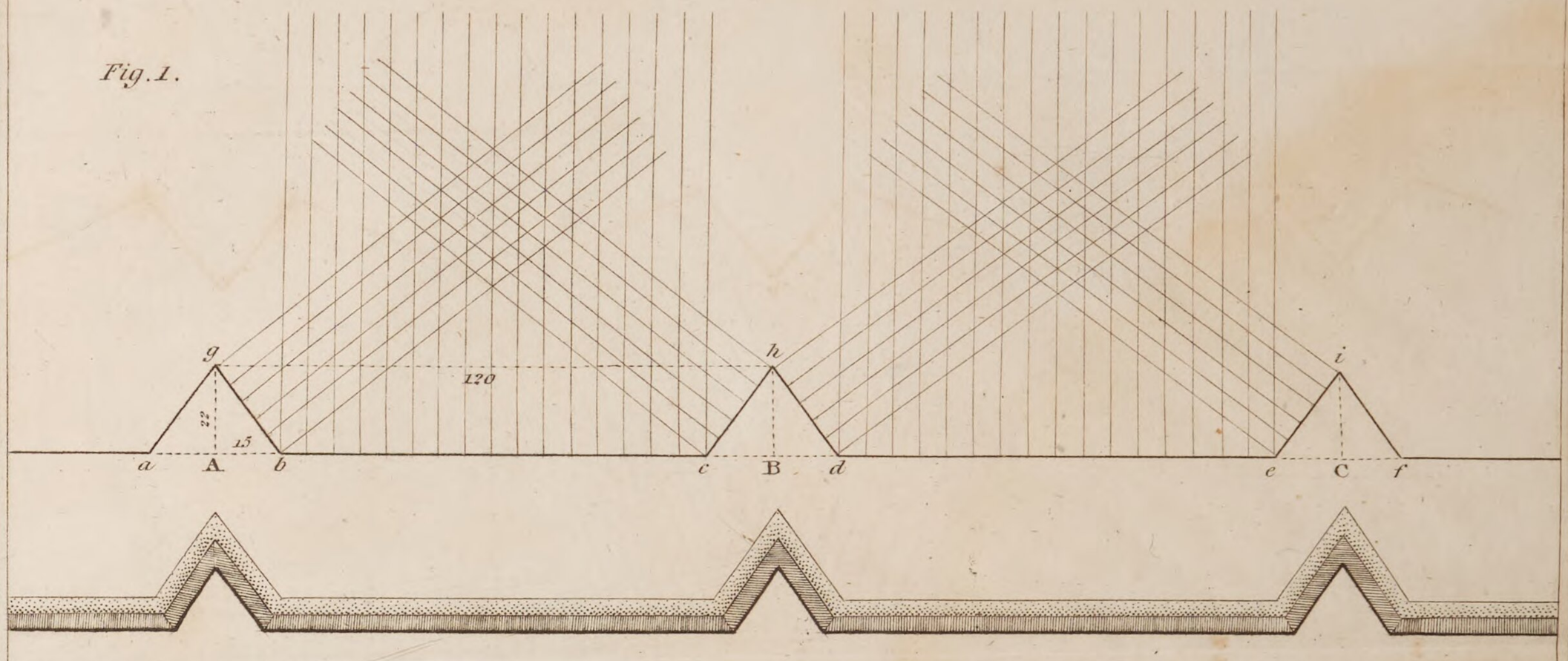


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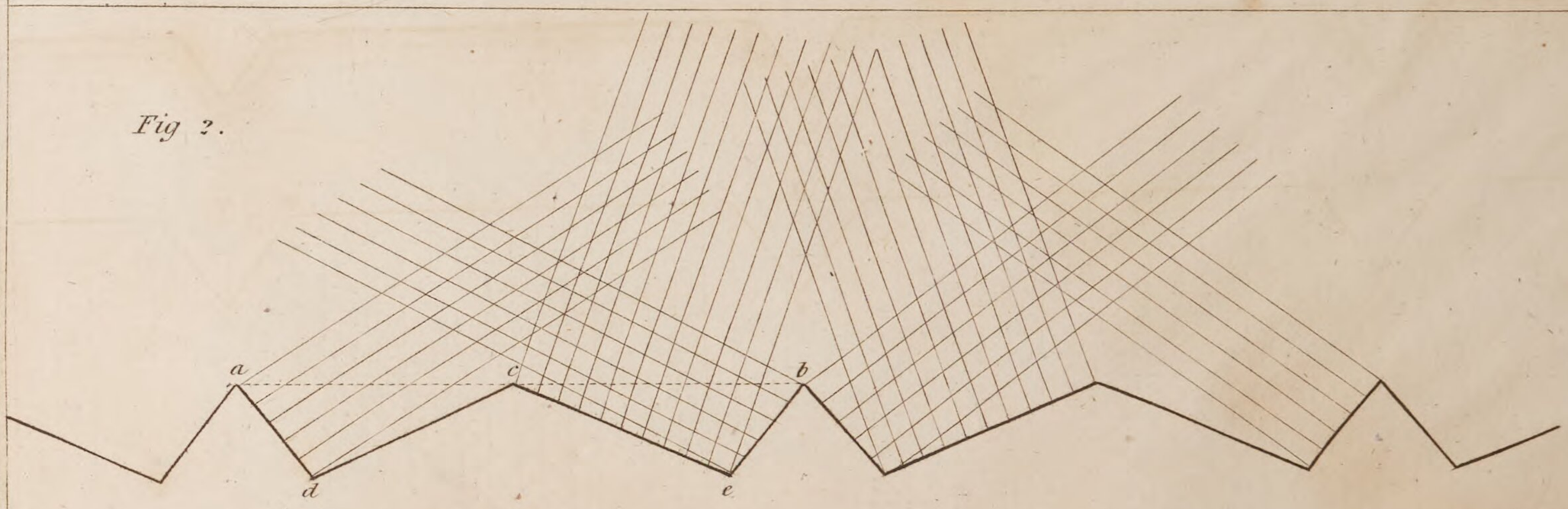


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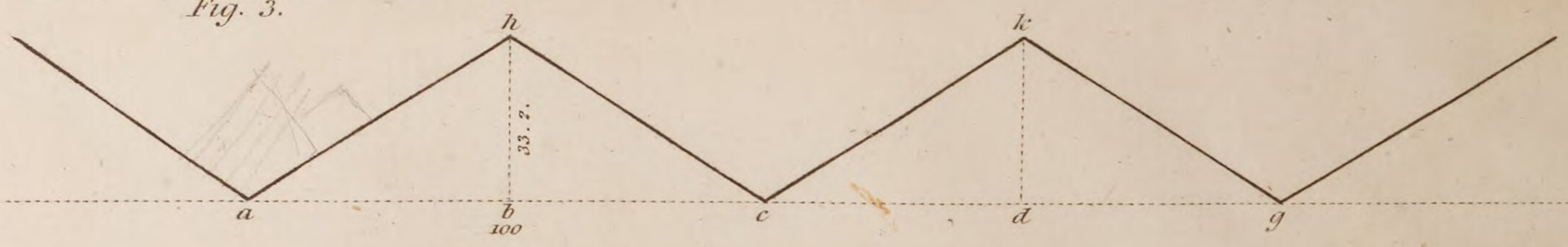


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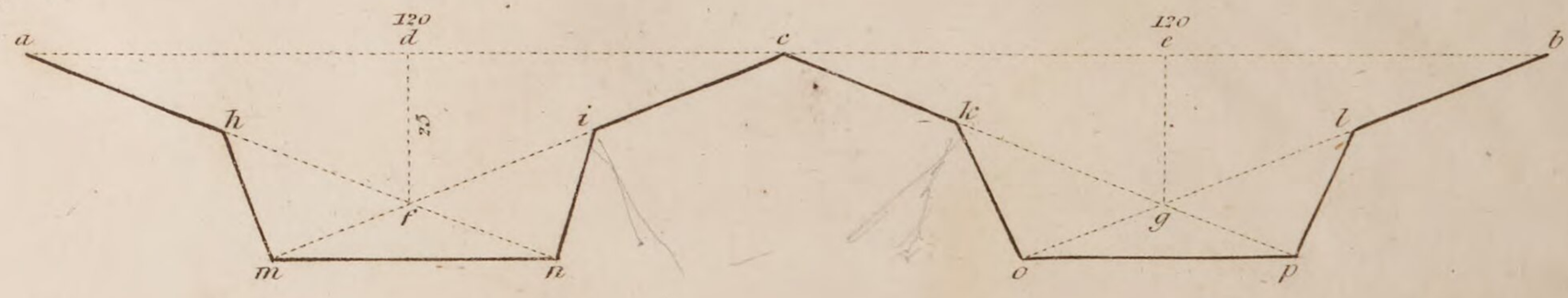




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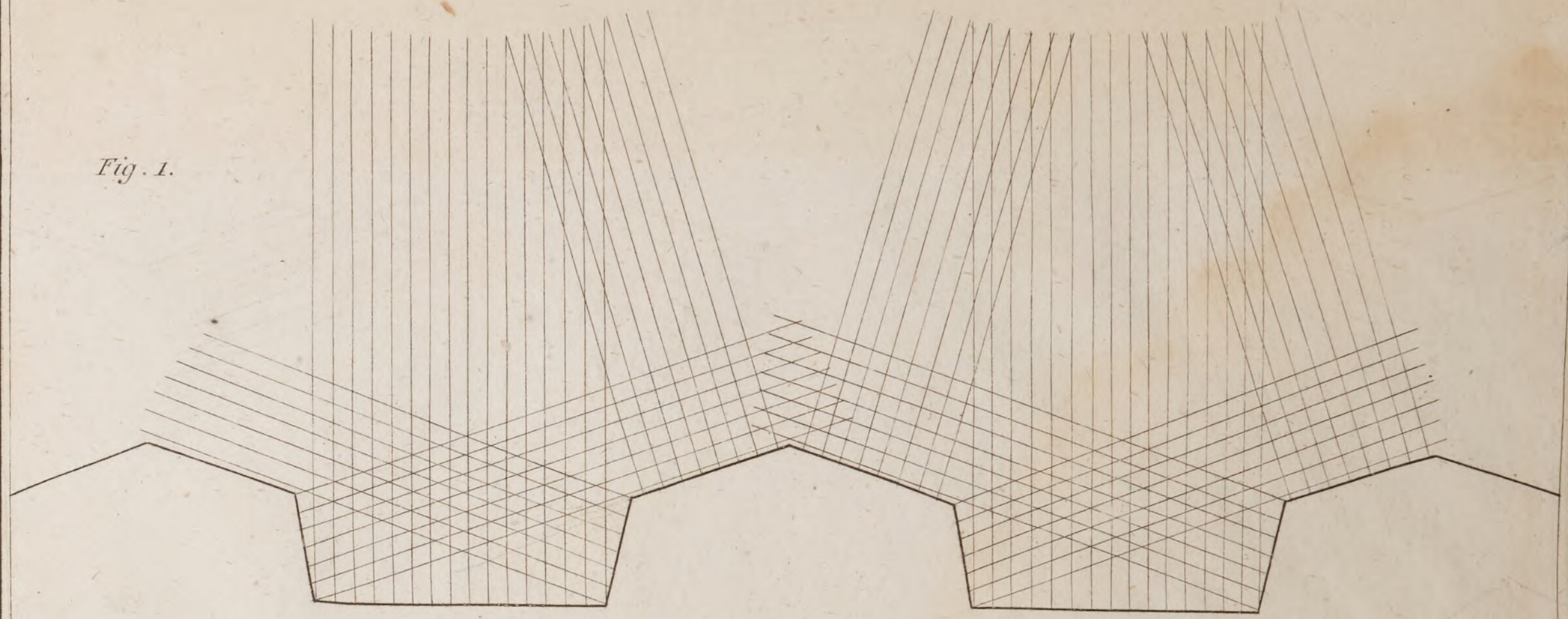


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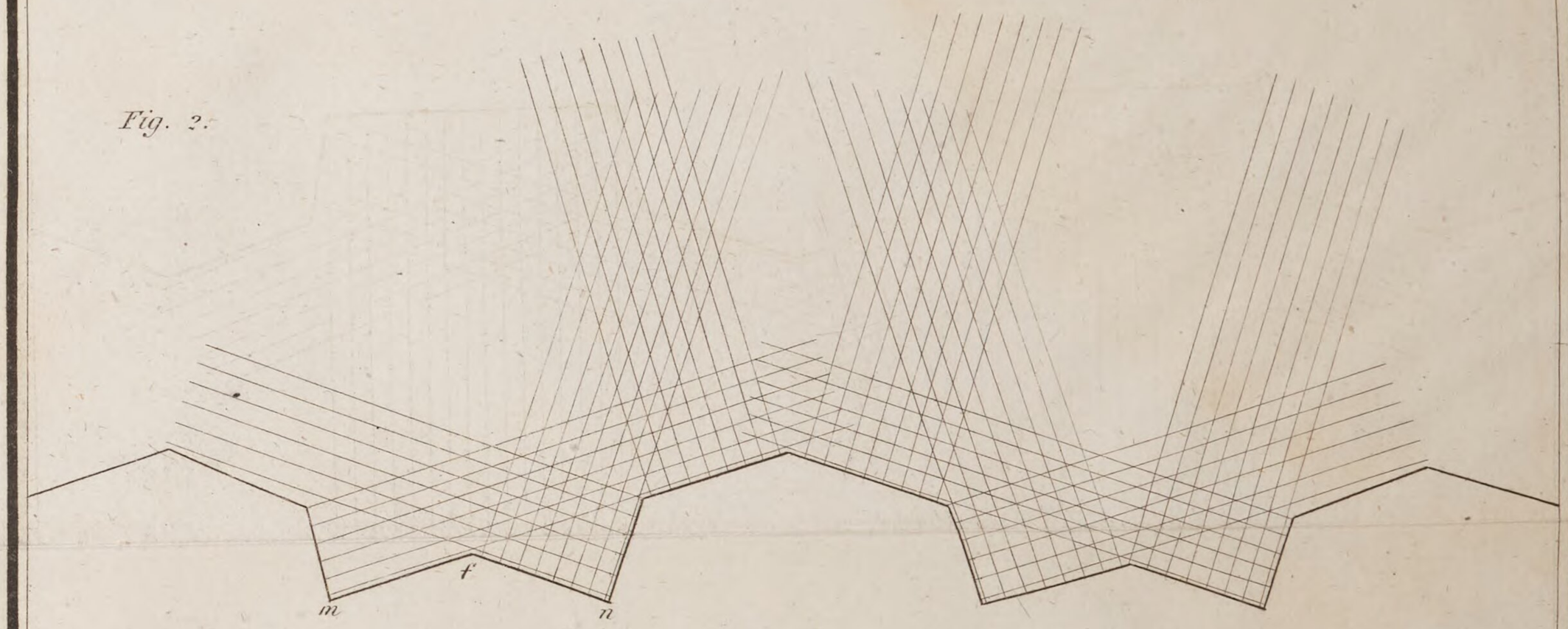


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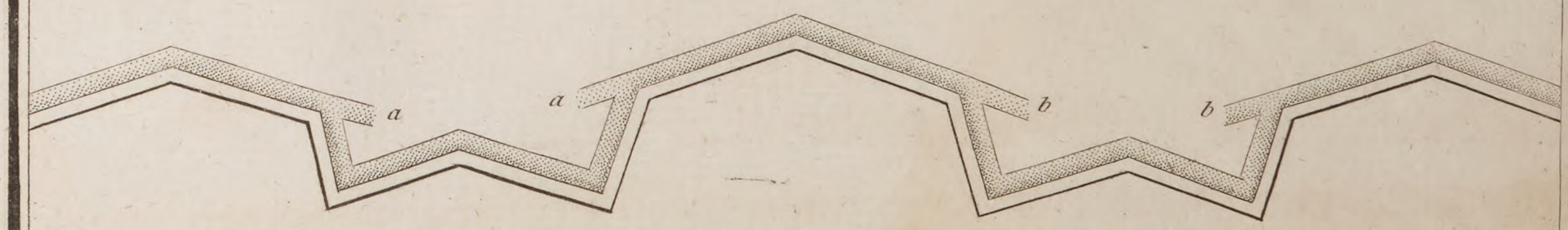


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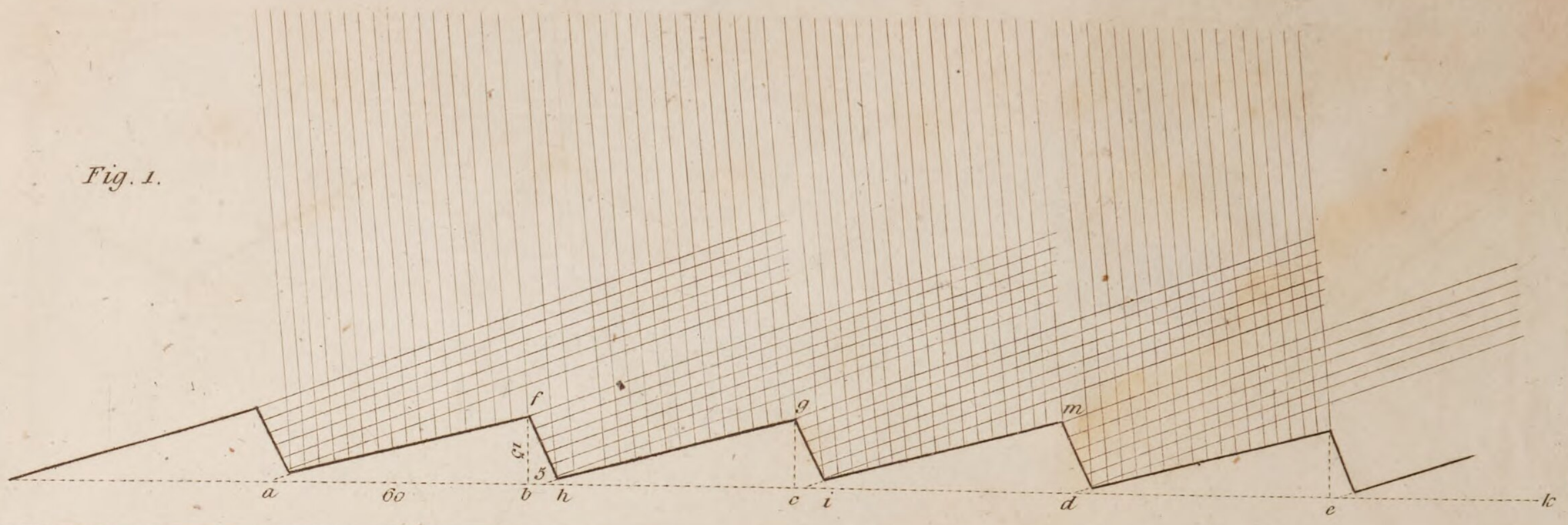


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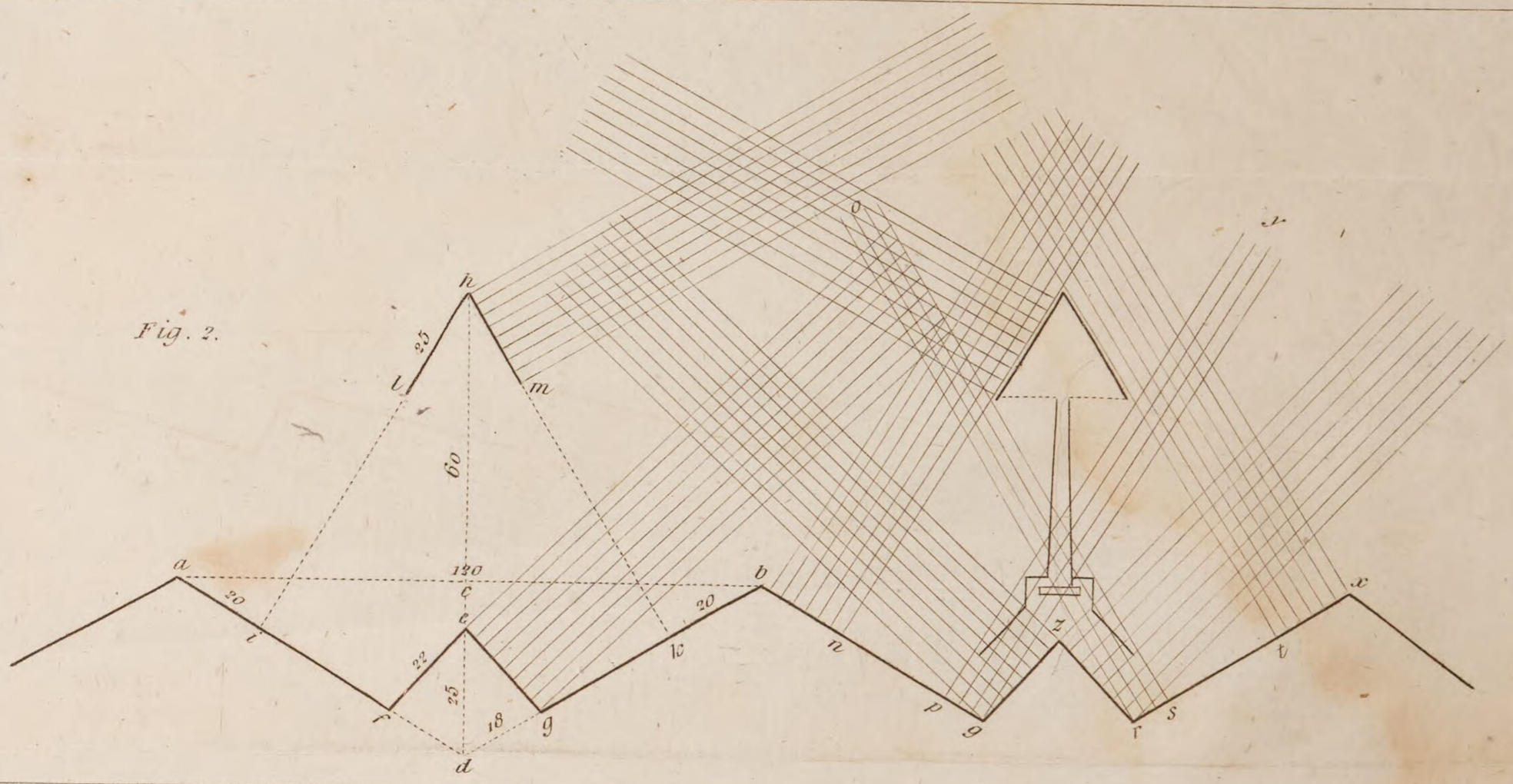


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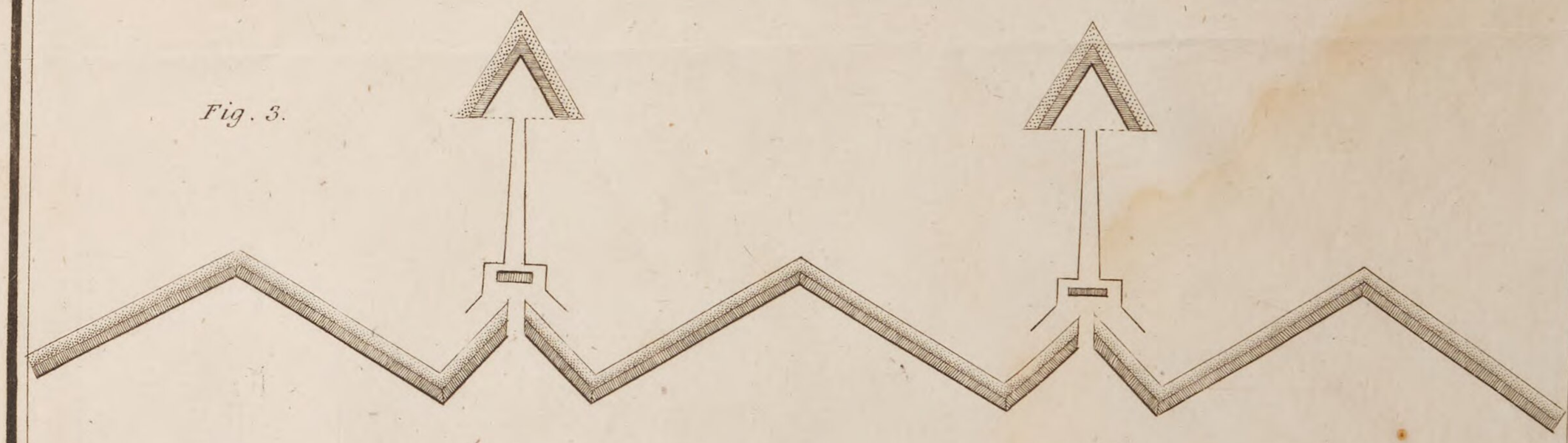


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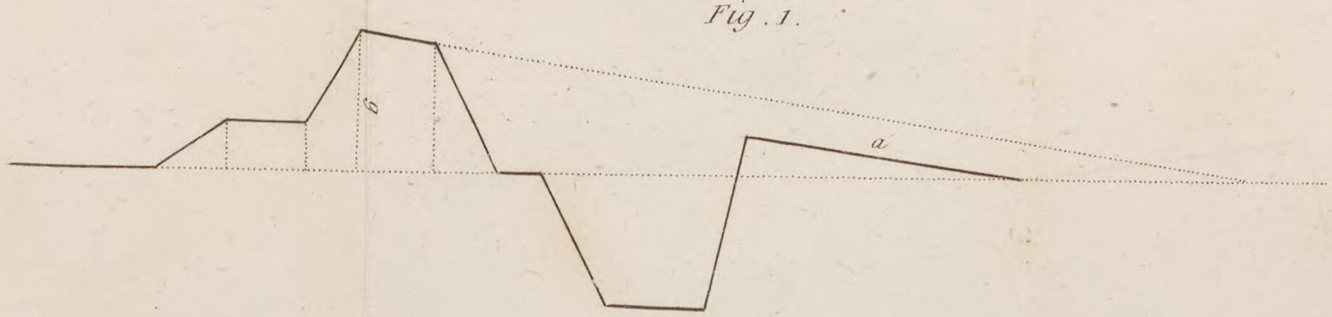


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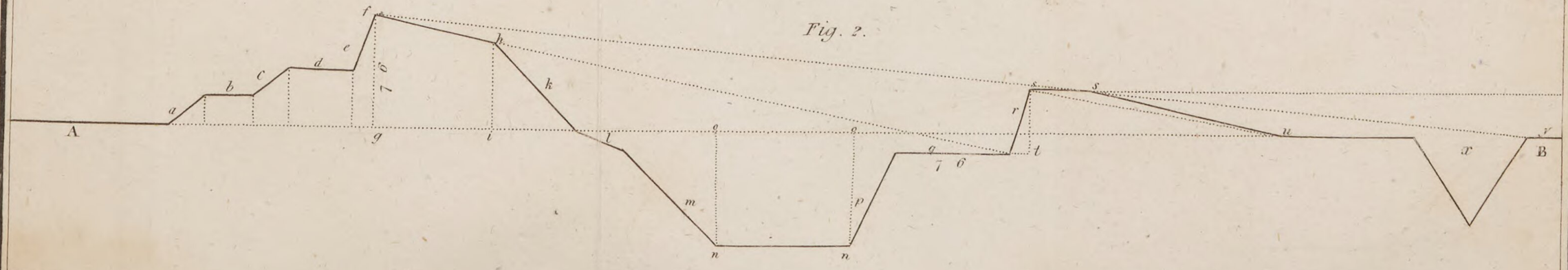
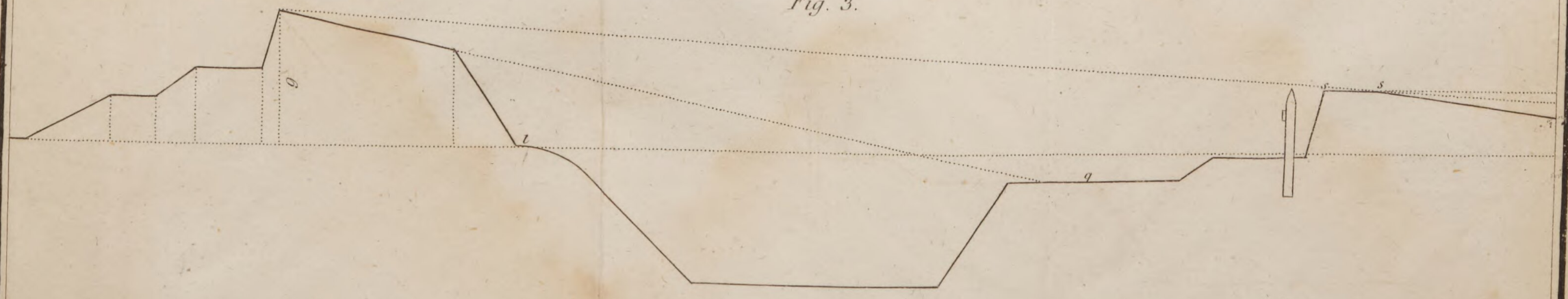


Fig. 3.



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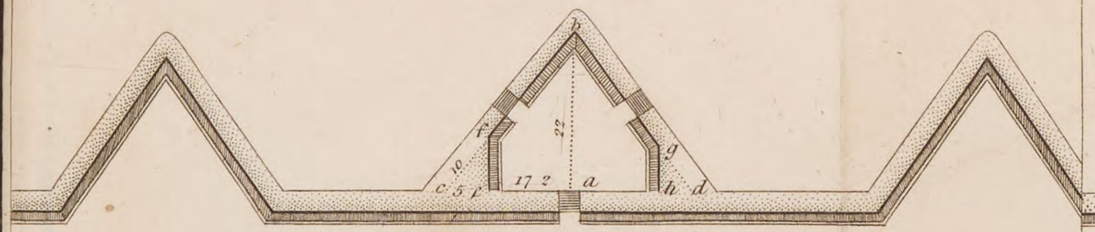


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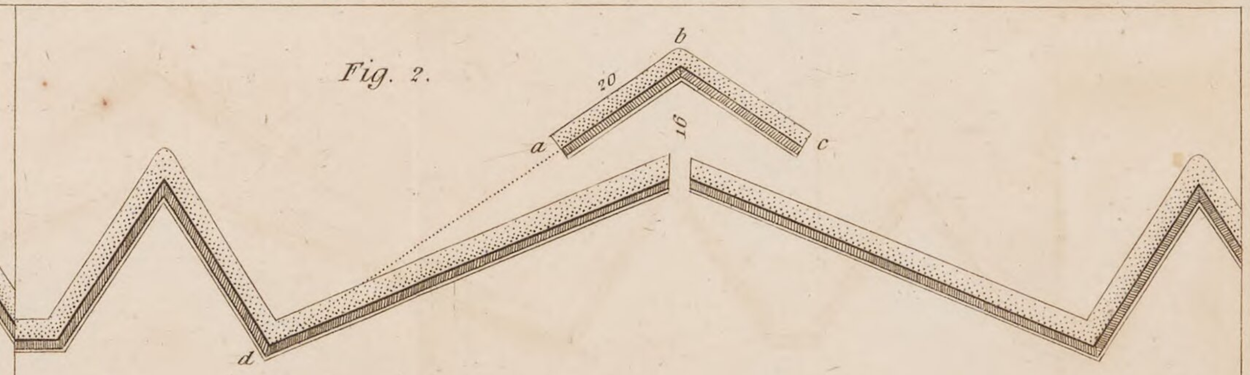


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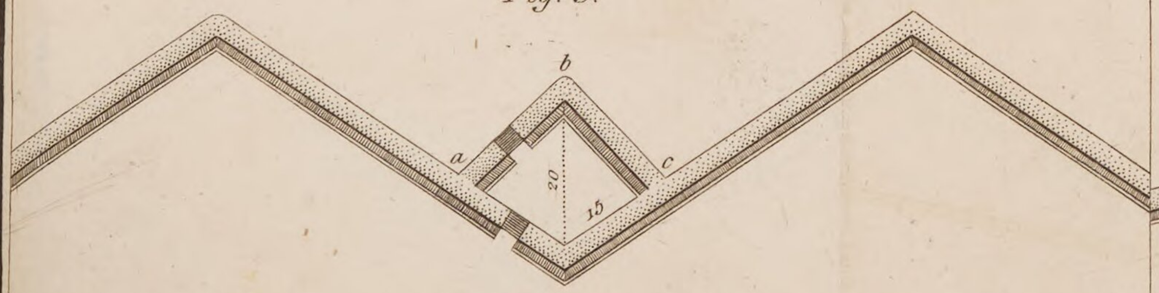


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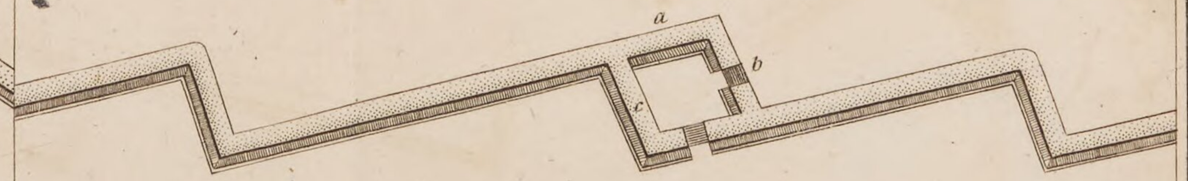


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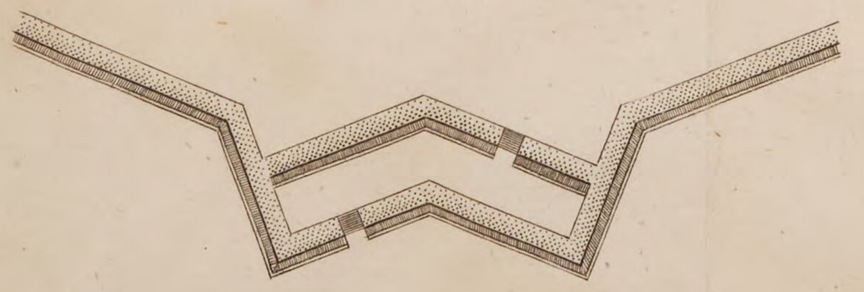


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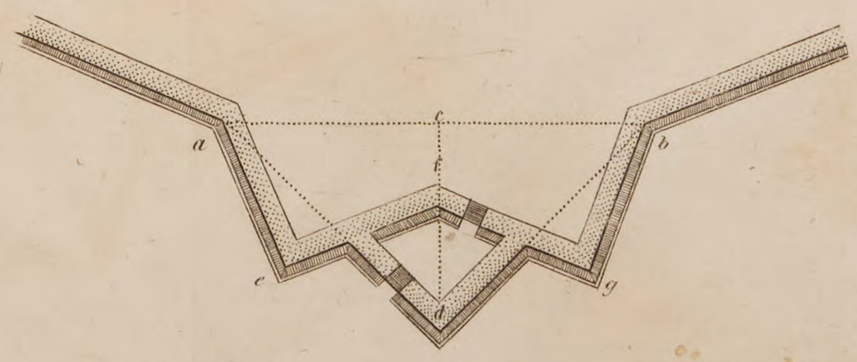
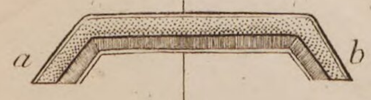


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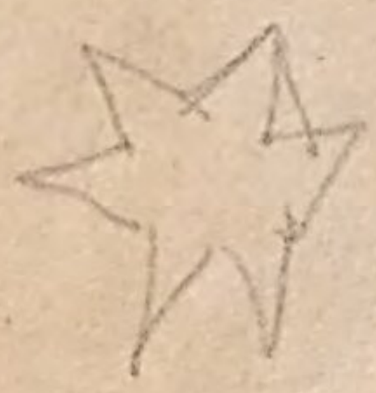


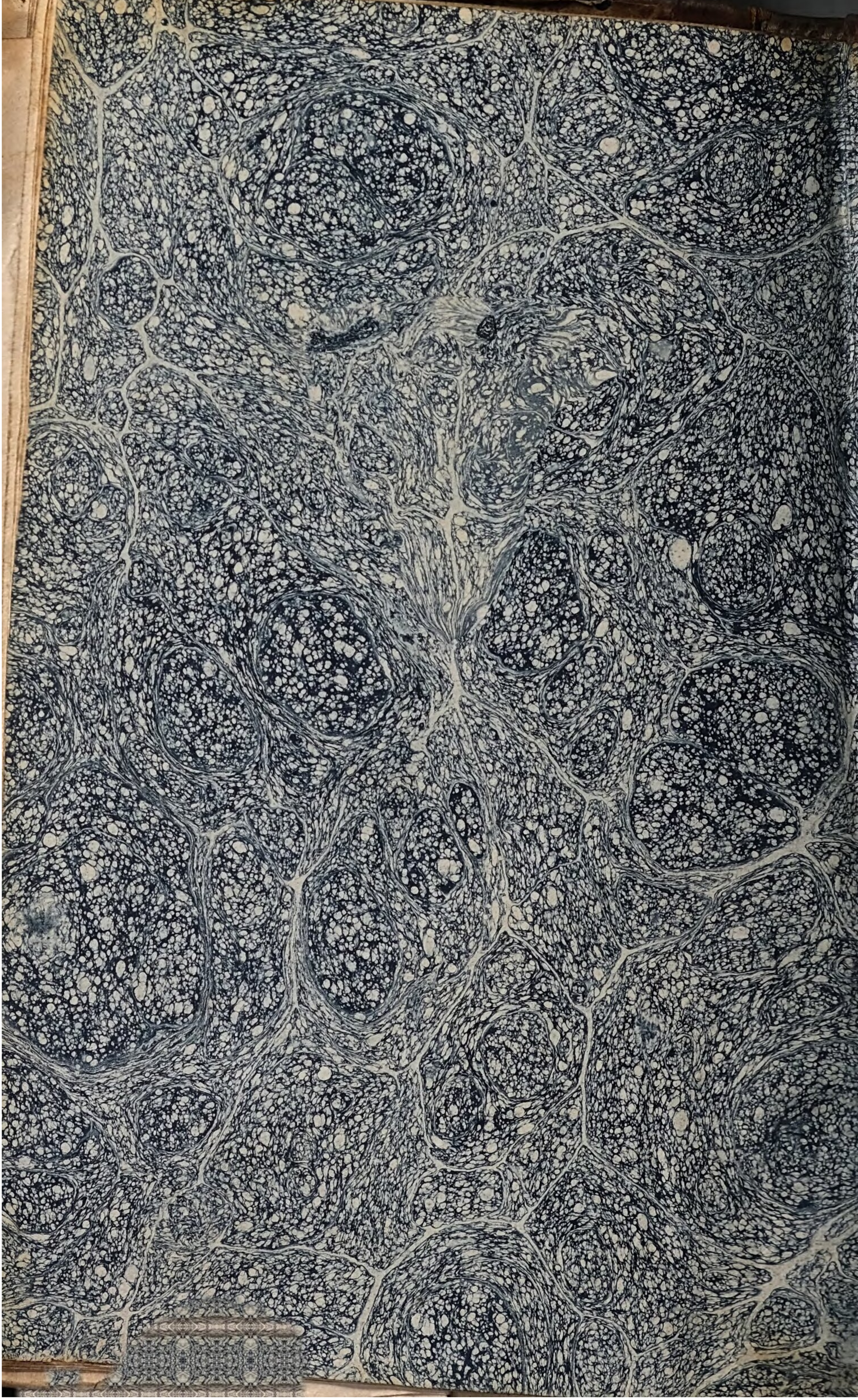
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